AECOM

Report

Saskatchewan Watershed Authority

Regina East
Ground Water Demand Study

Saskatchewan Watershed Authority

AECOM

Saskatchewan Watershed Authority

Regina East
Ground Water Demand Study

Prepared by:

AECOM Canada Ltd.
2629 29th Avenue, Regina, SK, Canada S4S 2N9
T 306.584.8580 F 306.584.3822 www.aecom.com

Project Number:

111751 - 3

Date:

July 22, 2009

Statement of Qualifications and Limitations

The attached Report (the "Report") has been prepared by AECOM Canada Ltd. ("Consultant") for the benefit of the client ("Client") in accordance with the agreement between Consultant and Client, including the scope of work detailed therein (the "Agreement").

The information, data, recommendations and conclusions contained in the Report:

- are subject to the scope, schedule, and other constraints and limitations in the Agreement and the qualifications contained in the Report (the "Limitations");
- represent Consultant's professional judgement in light of the Limitations and industry standards for the preparation of similar reports;
- may be based on information provided to Consultant which has not been independently verified;
- have not been updated since the date of issuance of the Report and their accuracy is limited to the time period and circumstances in which they were collected, processed, made or issued;
- must be read as a whole and sections thereof should not be read out of such context;
- were prepared for the specific purposes described in the Report and the Agreement; and
- in the case of subsurface, environmental or geotechnical conditions, may be based on limited testing and on the assumption that such conditions are uniform and not variable either geographically or over time.

Unless expressly stated to the contrary in the Report or the Agreement, Consultant:

- shall not be responsible for any events or circumstances that may have occurred since the date on which the Report was prepared or for any inaccuracies contained in information that was provided to Consultant;
- agrees that the Report represents its professional judgement as described above for the specific purpose described in the Report and the Agreement, but Consultant makes no other representations with respect to the Report or any part thereof; and
- in the case of subsurface, environmental or geotechnical conditions, is not responsible for variability or uncertainty in such conditions geographically or over time.

The Report is to be treated as confidential and may not be used or relied upon by third parties, except:

- as agreed by Consultant and Client;
- as required by law;
- for use by governmental reviewing agencies.

Any use of this Report is subject to this Statement of Qualifications and Limitations. Any damages arising from improper use of the Report or parts thereof shall be borne by the party making such use.

This Statement of Qualifications and Limitations is attached to and forms part of the Report.

AECOM

AECOM
2629 29th Avenue, Regina, SK, Canada S4S 2N9
T 306.584.8580 F 306.584.3822 www.aecom.com

July 22, 2009

Project Number: 111751-03

Mr. Nolan Shaheen, P.Eng., P.Geo.
Director, Ground Water Management
Saskatchewan Watershed Authority
111 Fairford Street East
Moose Jaw, Saskatchewan
S6H 7X9

Dear Sir:

Re: Final Report
Regina East Ground Water Demand Study

Please find enclosed sixteen (16) copies of the Final Report for the Regina East Ground Water Demand Study.

If you have any questions or concerns, please contact us.

Sincerely,
AECOM Canada Ltd.

Omar Lopez, EIT
Project Engineer
omar.lopez@aecom.com

Bill Wright, P.Eng.
Manager, Municipal Infrastructure
william.wright@aecom.com

OEL:jas

Encl.

Distribution List

# of Copies	Association / Company Name	PDF	Hard Copy
16	Mr. Cas Rogal - Saskatchewan Watershed Authority	X	X
1	AECOM Canada Ltd. - File	X	X

Revision Log

Revision #	Revised By	Date	Issue / Revision Description
1	B. Wright	March 28, 2009	Reviewed
2	B. Wright	April 21, 2009	Final
3	B. Wright	May 13, 2009	Final
4	O. Lopez	July 13, 2009	Final

Signature Page

Report Prepared By:		Report Reviewed By:
Omar Lopez		Bill Wright
Omar Lopez, EIT		Bill Wright, P.Eng.

CERTIFICATE OF AUTHORIZATION
AECOM Canada Ltd.
NUMBER C1667

PROFESSIONAL ENGINEER
W.A. WRIGHT
SASKATCHEWAN
09 02 21

Table of Contents

Statement of Qualifications and Limitations
Letter of Transmittal
Distribution List
Revision Log
Signature Page

page

1. Introduction 1
1.1 Background 1
1.2 Study Scope and Objectives 2
2. Aquifers in the Regina East Area 4
2.1 Hydrogeology 4
2.2 Withdraw Allocation 6
3. Water Demand 7
3.1 Population Analysis 7
3.2 Typical Water Consumptions Rates 8
3.3 Town of Balgonie 8
3.4 Town of Pilot Butte 11
3.5 Town of White City 15
3.6 Emerald Park 19
3.7 Rural Municipalities 22
3.8 City of Regina 24
3.9 Clear Vistas Community 25
4. Summary 27
4.1 Population Projections 27
4.2 Water Allocation Summary 29
4.3 Water Demands Summary 30
5. Water Conservation 32
5.1 Water Conservation 32
6. Conclusions and Recommendations 36
6.1 Conclusions 36
6.2 Recommendations 38

page

List of Figures

Figure 1.1	Aquifer Systems East of Regina	1
Figure 2.1	Aquifer Location Plan	4
Figure 2.2	Interaction Diagram for Zehner and Condie Aquifers	5
Figure 3.1	Population and Water Demand Projections for the Town of Balgonie	10
Figure 3.2	Population and Water Demands for the Town of Pilot Butte using Base Growth Rate	13
Figure 3.3	Population and Water Demands for the Town of Pilot Butte with Development Plans	14
Figure 3.4	Population and Water Demands for the Town of White City	17
Figure 3.5	Population and Water Demands for Emerald Park	20
Figure 3.6	Population and Water Demands for Emerald Park	21
Figure 4.1	Estimated 2008 Population Breakdown	27
Figure 4.2	2008 Estimated Water Use Breakdown from the Regina East Aquifer System	30
Figure 5.1	Typical Residential Water Use	33

List of Tables

Table 2.1	Estimated Net Recharge Rates for the Zehner and Condie Aquifers	5
Table 2.2	Aquifer Water Withdrawal Allocation (cu.dam/year)	6
Table 3.1	Estimated Base Growth Rates	7
Table 3.2	Population Projections for the Town of Balgonie	8
Table 3.3	Estimated Year of Full Development	9
Table 3.4	Town of Balgonie Well Information	9
Table 3.5	Water Demand Projections for the Town of Balgonie	9
Table 3.6	Population Projections for the Town of Pilot Butte	11
Table 3.7	Water Demand Projections for the Town of Pilot Butte	12
Table 3.8	Population Projections for the Town of White City	15
Table 3.9	Well Information	15
Table 3.10	Projected Water Demand for the Town of White City	16
Table 3.11	Population Projections for Emerald Park	19
Table 3.12	Projected Water Demand for Emerald Park	19
Table 3.13	Combined Water Demands for the Town of White City and Emerald Park	20
Table 3.14	Net Rural Population Projected for the RM of Edenwold	22
Table 3.15	Projected Water Demand for RM's Rural Population	23
Table 3.16	City of Regina Active Well Summary	24
Table 3.17	Estimated Water Demand for the City of Regina	24
Table 3.18	Population Projections for Clear Vistas	25
Table 3.19	Estimated Water Demand for Clear Vistas	26

Page

Table 4.1 Total Population Projections for Regina East Area 28
Table 4.2 Aquifer Water Withdrawal Allocation (cu.dam/year) 29
Table 4.3 Water Demands Summary for the Regina East Area Aquifers Systems ..... Follows 30
Table 5.1 Comparison of the Regina East Average Water Demands with and without Conservation Methods 35
Table 6.1 Population Summary for the Regina East Area for the Next 10 Years 36
Table 6.2 Aquifer Water Withdrawal Allocation (cu.dam/year) 36
Table 6.3 Water Demands Summary for the Regina East Area 38

Appendices

A. Regina Aquifer Plan Part A – Allocation Plan, Clifton Associates, 1989

Section 1

Introduction

1. Introduction

1.1 Background

Development in the area east of the City of Regina has increased significantly in the past decade. Municipalities and rural residents in the Regina East Area generally obtain water from the Condie and the Zehner Aquifers. The extent of aquifers and major municipalities in the study area are shown in **Figure 1.1.**

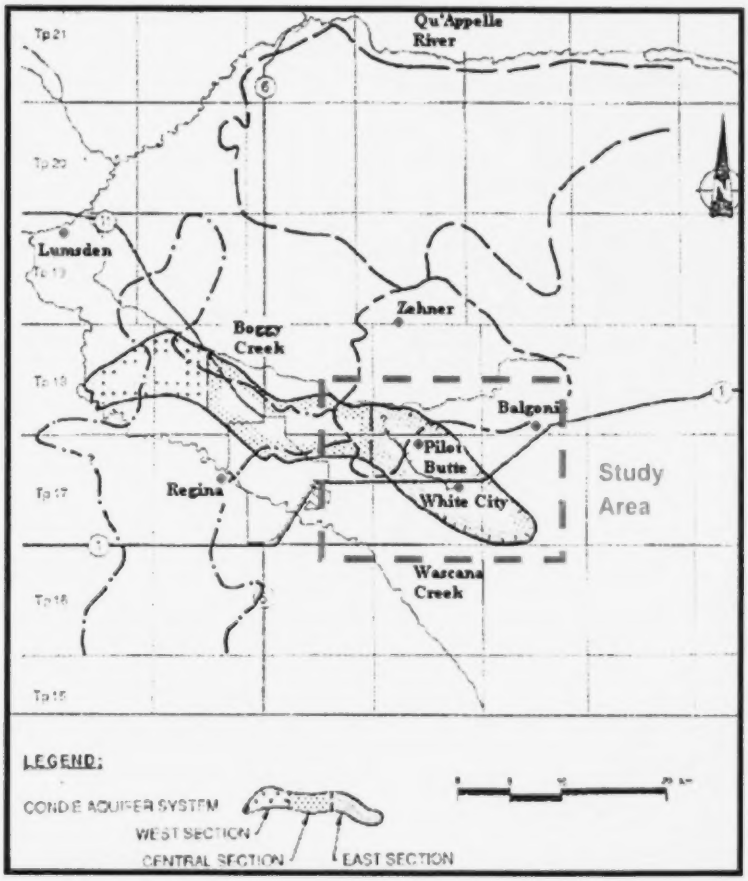


Figure 1.1 - Aquifer Systems East of Regina
(From Maathuis and van de Kamp, 1988)

In 1987, SaskWater developed the Regina Aquifer Management Plan to complete a detailed geologic and hydrologic study of various aquifers in the Regina area. The Saskatchewan Research Council publication "Comprehensive Evaluation of the Ground Water Resources in the Regina Area" by Maathuis and van de Kamp was completed in 1988 to determine the water available from the various aquifers.

In the same year, Stanley Associates Engineering Ltd. completed the "Ground Water Demand Study" to determine existing and estimate future ground water consumption in the area. Stanley's study identified the City of Regina as the dominant ground water user at the time. The study included population and water consumption forecasts from 1987 to 2000 for the following municipalities: City of Regina, Town of Pilot Butte, Town of Balgonie, Town of White City, Rural Municipality of Edenwold and Rural Municipality of Sherwood.

In the 1980s, the Regina Aquifer Technical Committee concluded the Zehner Aquifer was over-allocated, meanwhile the Condie Aquifer had some additional capacity.

1.2 Study Scope and Objectives

Saskatchewan Watershed Authority has commissioned AECOM Canada Ltd. to assess the current and future water demands for all communities in the Regina East Area for the next 10 years.

The study also reviews the current ground water allocations provided to each community. Finally, the study includes an overview of water conservation and efficiency measures to preserve water and reduce demand.

The major stakeholders that are known to currently use or plan to use the aquifers include:

- Town of Balgonie
- Town of Pilot Butte
- Town of White City
- Emerald Park
- Rural Municipality of Edenwold
- City of Regina
- Clear Vistas Community
- SaskWater
- North Ridge Developments

Each stakeholder was contacted to request information about existing populations, existing water use, population growth projections and future development plans. Historic population records were obtained through the Saskatchewan Health Covered Population Records and compared with data obtained from census years. Population projections are developed based on historical growth patterns and planned developments.

Documents used in the preparation of this report are summarized below:

- AECOM Canada Ltd. - Town of Balgonie Water System Review, Planning Study and Growth Projections, Draft Report, March 2009

- Clifton Associates Ltd. - Regina Aquifer Management Plan Part A, Allocation Plan, July 1989
- Saskatchewan Health Covered Population – 4 Regina Qu'Appelle Regional Health Authority from 2002 to 2008
- Saskatchewan Watershed Authority - Saskatchewan Community Water Use Records 1985 to 2002, Report No. 16, June 2003
- Saskatchewan Watershed Authority - Saskatchewan Community Water Use Records 1993 to 2007, Report No. 21, June 2008
- Stanley Associates Engineering Ltd. - Ground Water Demand Study, February 1988
- Statistics Canada - 2006, 2001 and 1996 Census of Population, Community Profiles
- Town of Pilot Butte - 2007 Official Community Plan, 2007
- Crosby Hanna & Associates Ltd. – 2007 – Residential Land Consumption Forecast for the White City Basic Planning Statement Update (Draft)
- Water Mark Consulting Ltd. - Town of Balgonie Ground Water Supply Investigation, Phase 2, December 2008

The study is based on a review of historical population trends and water use for the various communities or communities of similar size and is only intended to provide an estimate of the possible future demands for water that may be expected in the entire study area. Saskatchewan Watershed Authority is undertaking a separate study to assess the availability of water from the aquifer system.

Section 2

Aquifers in the Regina East Area

2. Aquifers in the Regina East Area

2.1 Hydrogeology

The Saskatchewan Research Council's publication "Comprehensive Evaluation of the Ground Water Resources in the Regina Area" by Maathuis and van de Kamp was used as a reference for information on aquifers in the study area. The summary of Maathuis and van de Kamp's report prepared by Clifton Associates can be found in Appendix A - Regina Aquifer Plan Part A - Allocation Plan, 1989.

Aquifers in the Regina area include the Northern Aquifer, the Regina Aquifer, the Condie Aquifer and the Zehner Aquifer. The study area is located above the Condie and the Zehner Aquifer systems. **Figure 2.1** shows the location of the Condie and Zehner Aquifers in the area east of Regina.

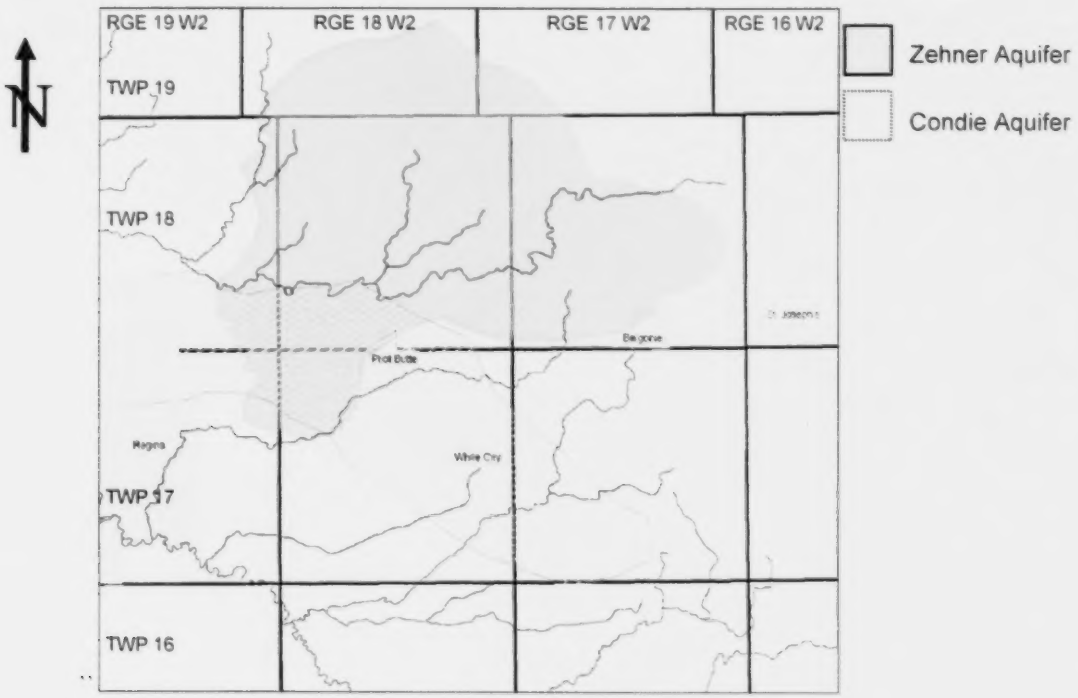


Figure 2.1 – Aquifer Location Plan

The Regina, Condie and Zehner Aquifers are recharged mainly by infiltration. **Figure 2.2** illustrates the infiltration rates and interaction between the aquifers as reported by Maathuis and van de Kamp, 1988.

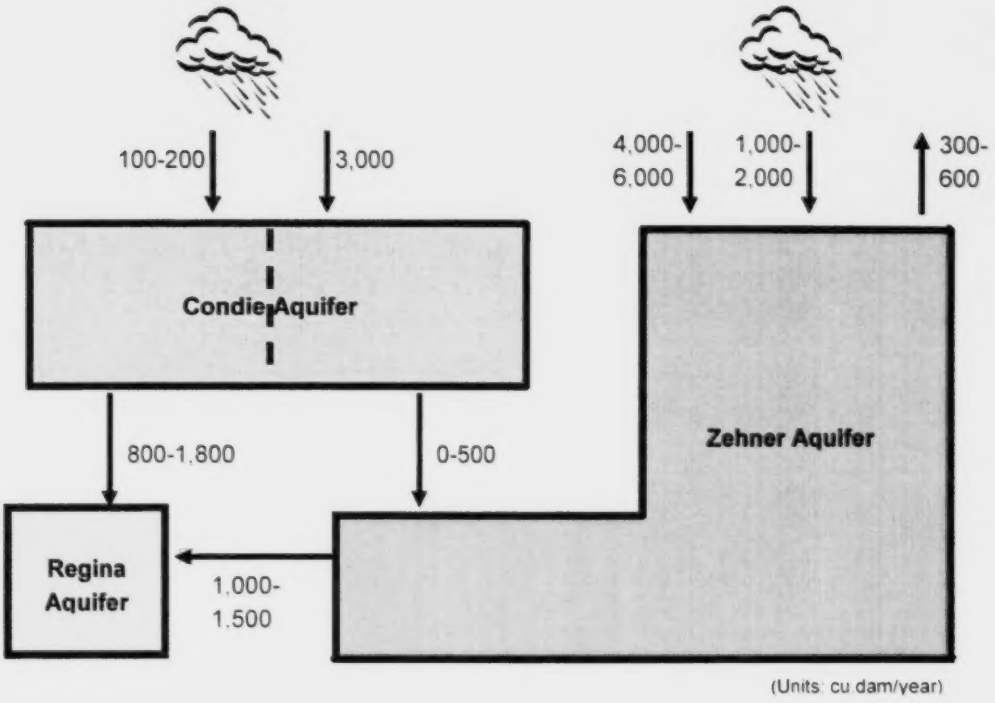


Figure 2.2 - Interaction Diagram for Zehner and Condie Aquifers
(From Maathuis and van de Kamp, 1988)

Based on the above, the estimated net recharge rates for the Zehner and Condie Aquifers are summarized in **Table 2.1.**

Table 2.1 - Estimated Net Recharge Rates for the Zehner and Condie Aquifers

Aquifer	Minimum (cu.dam/year)	Maximum (cu.dam/year)	Average (cu.dam/year)
Condie	800	2,400	1,600
Zehner	2,900	7,200	5,050
Total	**3,700**	**9,600**	**6,650**

According to Maathuis and van de Kamp, the total ground water available from both the Condie and Zehner Aquifers is estimated to be in the range of 3,700 to 9,600 cu.dam/year. Saskatchewan Watershed Authority is currently undertaking a separate study on ground water availability for the Regina East Area aquifer system to update the Maathuis and van de Kamp recharge rates.

2.2 Withdraw Allocation

Saskatchewan Watershed Authority regulates the allocation of water that can be withdrawn from each aquifer. The current allocation for each major stakeholder from each aquifer is summarized in **Table 2.2**.

Table 2.2 – Aquifer Water Withdrawal Allocation (cu.dam/year)

Community	Zehner Aquifer	Condie Aquifer	Total
City of Regina	1,500 [1]	300 [1]	1,800
Town of Balgonie	318 [2]	0	318
SaskWater (Town of White City and Emerald Park)	438 [3]	0	438
Town of Pilot Butte	0 [4]	0	0
RM of Edenwold	0 [5]	0	0
Total	**2,256**	**300**	**2,556**

Notes:

1. The City of Regina values are currently higher but are planned to be revised as shown.
2. The Town of Balgonie has requested an increase in the allocation to 400 cu.dam/year.
3. SaskWater has requested an increase in the allocation for the Town of White City and Emerald Park to 700 cu.dam/year.
4. The Town of Pilot Butte has requested an allocation of 800 cu.dam/year.
5. The RM of Edenwold has requested an allocation of 400 cu.dam/year.

This study does not make any evaluation or recommendation for the current or future allocation for the communities in the study area.

Section 3

Water Demand

3. Water Demand

3.1 Population Analysis

Both Saskatchewan Health and Census Canada records were reviewed to assess the historical population growth for each community. Typically, Canada Census records provide a lower total population compared to Saskatchewan Health. However, the Canada Census growth rate typically mimics Saskatchewan Health growth rates.

The discrepancy between agencies may be due to Saskatchewan Health statistics including rural residents with postal addresses in the various towns. The difference could also be related to residents not completing census forms. For this study, Saskatchewan Health records are used, as this represents the most conservative approach.

A statistical analysis on the historical population records was completed for each community to estimate a future growth rate. A low and high growth rate was established by subtracting or adding one standard error from the average. Statistically, a standard error is the standard deviation of the sample mean and defines the interval around which the true measure will fall 68% of the time. The remaining 32% (16% at the lower end and 16% at the higher end) of the measures will fall beyond the one standard deviation threshold.

Using this method, the low, average and high base growth rates for the existing communities are summarized in **Table 3.1**.

Table 3.1 – Estimated Base Growth Rates

	Balgonie	Pilot Butte	White City	Emerald Park	RM of Edenwold (Rural Population)
Low	2.5%	0.3%	2.4%	1.0%	-3.1%
Average	3.0%	0.8%	4.0%	3.0%	-1.4%
High	3.5%	1.3%	5.6%	3.0%	0.0%

The population growth rates for the RM of Edenwold shown are for the rural population only.

Emerald Park is considered within the RM of Edenwold, therefore no separate population records are available. Population numbers and growth projections for Emerald Park were provided by SaskWater.

Population densities were obtained from the 2006 census. Densities in the study area range between 2.9 to 3.1 persons per residence.

The above table is used to establish a base growth rate for each community. In addition, several new developments are planned in the area and are considered for each community in addition to the base growth. New development plans, if any, for each community are discussed further in the following sections.

3.2 Typical Water Consumptions Rates

Water consumption rates vary from community to community and time of year. The average daily water use for a community is typically determined by taking the average water use during the year and dividing by the total population to arrive at a per capita water consumption rate.

If actual data is not available, a design water consumption rate of 454 L/c/d is typically used for the design of new water systems. This value is intended to account for the combined residential, commercial and industrial users. Leakage from water distribution systems and process water from water treatment plants may also contribute to higher consumption rates.

Communities with little or no commercial and industrial development will typically have lower per capita consumption rates. A typical design consumption rate for small communities comprised primarily of residential developments is 270 L/c/d.

Water consumption rates for communities in the study area range from around 215 L/c/d in White City to 355 L/c/d in Balgonie. Historical consumption rates for communities in the study area were used wherever possible to project future demands.

3.3 Town of Balgonie

The Town of Balgonie currently has plans to develop an additional 414 new lots in the future. Based on a population density of 2.9 persons per household as reported in the 2006 Canada Census, the population of Balgonie would ultimately increase from 1,865 to 3,065 after all proposed developments are completed.

Using the estimated base growth rates developed previously, population projections for the Town of Balgonie for the next ten years are shown in **Table 3.2**.

Table 3.2 - Population Projections for the Town of Balgonie

Year	Low (2.5%)	Average (3%)	High (3.5%)
2012	2,056	2,094	2,140
2015	2,205	2,275	2,362
2020	2,468	2,598	2,759

Table 3.3 shows the estimated year of full developments for each base growth rate.

Table 3.3 – Estimated Year of Full Development

Total Future Population	Low (2.5%)	Average (3%)	High (3.5%)
3,065	2030	2026	2023

The Town of Balgonie operates and maintains a water treatment plant to provide potable water to residents. Raw water is obtained from three ground water wells located approximately 3 kilometres northwest of the Town. **Table 3.4** summarize the existing well information.

Table 3.4 - Town of Balgonie Well Information

Details	Well No. 1	Well No. 2	Well No. 3
Year Constructed	1962	1966	1975
Aquifer	Zehner	Zehner	Zehner
Land Location	SW09-18-17W2M	SW09-18-17W2M	NE07-18-17 W2M
Total Depth (m)	32	30.5	36.6
Max. Rate of Diversion (cu.dam/year)	119.8	85.1	239.7

(From Water Mark Consulting Ltd., 2008)

Community Water Use Records from Saskatchewan Watershed Authority were analyzed to determine Balgonie's average water consumption rate. The average water consumption, based on the 22 years of records is 342 L/c/d. The "Water System Review Report (Draft)" by AECOM in 2009, proposed an average consumption of 355 L/c/d for new developments in the Town. For this study, a value of 355 L/c/d has been used.

Water demand projections for the Town of Balgonie for the next 10 years and at proposed development completion are shown in **Table 3.5.**

Table 3.5 - Water Demand Projections for the Town of Balgonie

Year	Low (2.5%) (cu.dam/year)	Average (3%) (cu.dam/year)	High (3.5%) (cu.dam/year)
2008		169.2 *	
2012	266.4	271.3	277.3
2015	285.7	294.8	306.0
2020	319.8	336.6	357.5
At Full Development (Pop. 3,065)	397.1	397.1	397.1

Last year of recorded water demand.

In 2008, Balgonie used 53% of the total ground water allocation of 318 cu.dam/year. The demand allocation for the Town of Balgonie is expected to be exceeded in 2020, 2018 or 2016 according to the low, average and high growth rates, respectively. Historical water demand records and water demand projections for the next 10 years are shown in **Figure 3.1.**

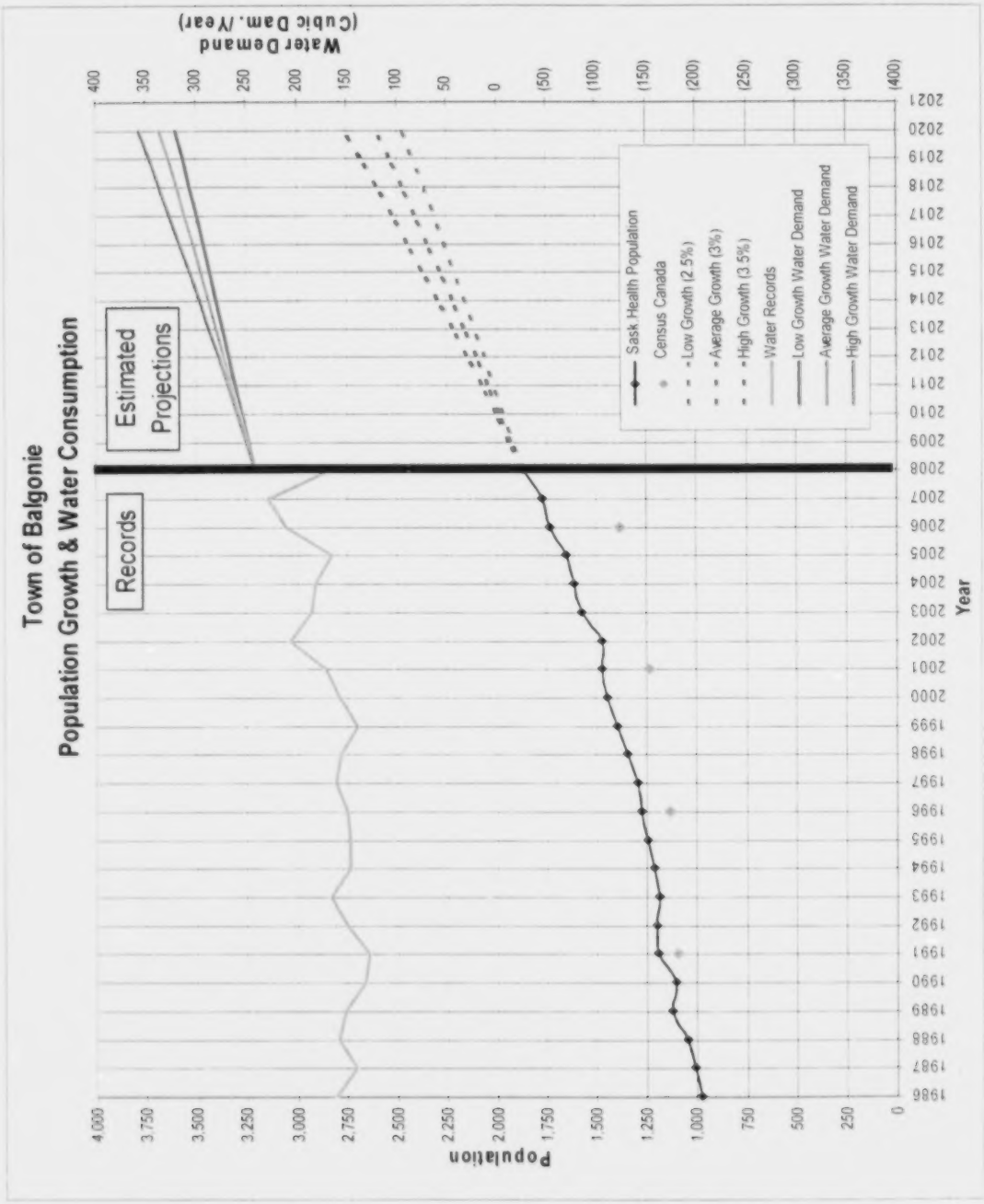


Figure 3.1 - Population and Water Demand Projections for the Town of Balgonie

3.4 Town of Pilot Butte

The population of Pilot Butte in 2008 is reported by Saskatchewan Health records to be 2,219. The Town has been contacted by three different developers including:

- North Ridge Developments has plans to build two new developments for a total of 493 new lots in the next 8 years.
- Two additional developers are planning to build 1,414 new lots. However, timeframe for completing the development is unknown.

Based on developers' population projections, the population of Pilot Butte is estimated to increase by 2,300 residents in the next ten years. The total population after all developments are completed in Pilot Butte is estimated to be 7,940. However, the exact timeframe for full build-out is not known.

Population growth projections for the next ten years in the Town of Pilot Butte, including the additional developments, are shown in **Table 3.6.**

Table 3.6 - Population Projections for the Town of Pilot Butte

Year	Low (0.3%)	Average (0.8%)	High (1.3%)	Developer Projections (6.1%)
2012	2,246	2,291	2,336	2,874
2015	2,267	2,346	2,425	3,434
2020	2,301	2,438	2,579	4,538

Based on the projected growth rates, the estimated full development population of 7,940 would be reached beyond 2030.

Residents in the Town of Pilot Butte currently obtain water from private wells. The Town reported approximately 615 private wells exist within the Town's limits. Since no records of private wells are maintained, it was assumed the Condie Aquifer is the source for the private wells.

Water consumption from private wells is not metered. Since no meter readings are available, an average of 355 L/c/d was used to calculate existing and projected water demands, similar to the Town of Balgonie. Water demand projections for the Town of Pilot Butte are shown in **Table 3.7.**

Table 3.7 – Water Demand Projections for the Town of Pilot Butte

Year	Low (0.3%) (cu.dam/year)	Average (0.8%) (cu.dam/year)	High (1.3%) (cu.dam/year)	Developers (6.1%) (cu.dam/year)
2008		287.5 *		
2012	291.1	296.8	302.7	372.4
2015	293.7	303.9	314.3	444.9
2020	298.2	315.9	334.3	588.1
Full Development (Pop. 7,940)	1,028.8	1,028.8	1,028.8	1,028.8

* Estimated water demand based on 2008 population.

Water demand records and water demand projections for the next ten years are shown in **Figure 3.2** using the base growth rates. **Figure 3.3** shows the water demand when new developments are included.

The Town of Pilot Butte is applying for funding of a centralized water treatment system to service a total population of 4,000. The centralized water system would include three new wells, a raw waterline, a treatment plant and one storage reservoir. If the funding is denied, the centralized system will not be built and no further developments will be permitted due to poor water quality and provincial regulations. The Town has requested an allocation of 800 cubic decametres a year for the water treatment facility. The most likely source of raw water for the proposed water treatment plant is the Zehner Aquifer.

Although North Ridge Developments has requested a separate aquifer allocation, they have indicated a preference to supply water to the new developments from other stakeholder's facilities, including SaskWater wells or Pilot Butte's proposed water treatment plant.

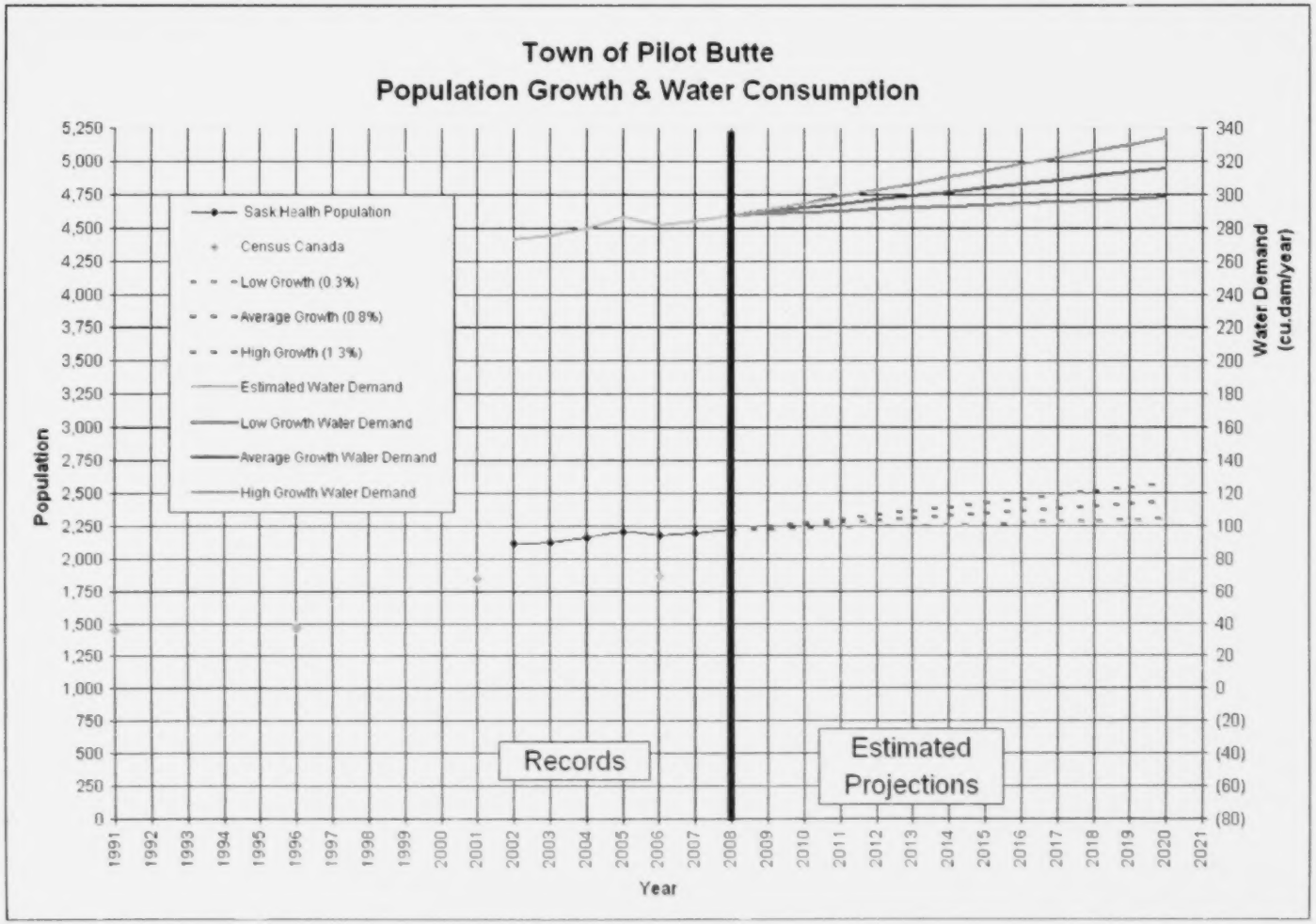


Figure 3.2 - Population and Water Demands for the Town of Pilot Butte using Base Growth Rate

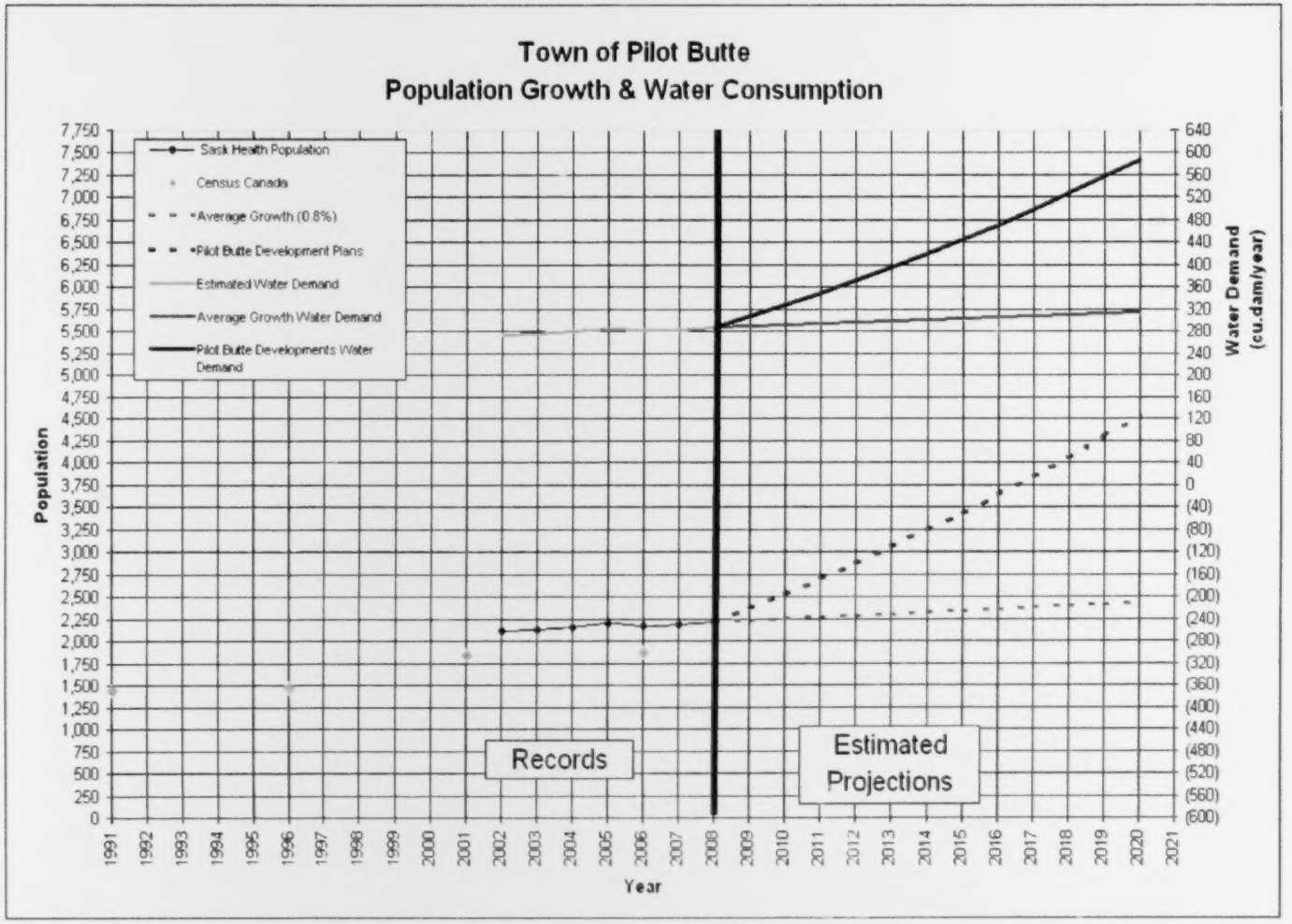


Figure 3.3 - Population and Water Demands for the Town of Pilot Butte with Development Plans

3.5 Town of White City

In 2008, the population of White City was reported as 2,018. Based on the high growth rate population projections, White City is projected to increase to a population of 3,627 residents by 2020. The high growth population projections are similar to those estimated in the "Residential Land Consumption Forecast for the White City Basic Planning Statement Update – Draft October 2007" report prepared by Crosby & Hanna Associated under the Three-year Housing Start Scenario.

Based on information provided by the Town of White City, the estimated total population at full development within the existing Town's limits may be in the range of 4,800 to 5,922 people. If the town's growth rates follow similar trends as those observed in 2006 - 2008, White City's full development is estimated to occur by 2018.

Using historical growth rates, population projections for the next ten years are shown in **Table 3.8.**

Table 3.8 - Population Projections for the Town of White City

Year	Low (2.4%)	Average (4%)	High (5.6%)	Town's Full Development Plan (8.8% - 11.0%)
2012	2,215	2,351	2,490	2,914 - 3,154
2015	2,368	2,620	2,882	3,745 - 4,301
2020	2,638	3,110	3,627	4,800** - 5,922**

** Populations projections based on White City achieving full development by 2018.

SaskWater operates and maintains two wells to supply raw water to the water treatment plants in Emerald Park and White City. Raw water is currently obtained from two wells founded in the Zehner Aquifer. SaskWater is in the process of commissioning a third well to ensure water supply to White City and Emerald Park. A summary of the wells supplying the water treatment plant is shown in **Table 3.9**.

Table 3.9 - Well Information

Details	Well No. 1	Well No. 2	Well No. 3 (to be commissioned)
Year Constructed	N/A	N/A	2009
Aquifer	Zehner	Zehner	Zehner
Land Location	NW13-29-18W2M	NW13-29-18W2M	SW02-6-18-18W2M
Total Depth (m)	54	56	77.7
Max. Rate of Diversion (cu.dam/year)	1,002.8	1,252.0	1,340.3

Note: N/A (No Information Available)

Community Water Use Records, published by Saskatchewan Watershed Authority, were analyzed to determine White City's current water demands. The average water consumption based on the last 22 years' of records is 215 L/c/d. An average of 225 L/c/d was used by up to 3,000 people. To account for potential increase in commercial developments as the community grows, a water consumption rate of 250 L/c/d was applied after the 3,000 population is reached.

Water demand allocation projections for the Town of White City for the next ten years are shown in **Table 3.10.**

Table 3.10 - Projected Water Demand for the Town of White City

Year	Low (2.4%) (cu.dam/year)	Average (4%) (cu.dam/year)	High (5.6%) (cu.dam/year)	Town's Full Development Plan (8.8% - 11.0%)**
				Range
2008		144.5 *		
2012	181.9	193.1	204.5	239.3 – 260.4
2015	194.5	215.2	236.7	314.3 – 365.1
2020	216.7	256.4	303.6	411.1 – 513.0**

* Last year of recorded water demand.

** Assuming full development is achieved by 2018

Historical water demand records and future water demand projections for the Town of White City for the next ten years are shown in **Figure 3.4** based on the low, average and high growth rates. **Figure 3.5** shows the water demand if full development within the existing town's limit is achieved as predicted by the Town of White City.

Many residents in the Town of White City also maintain wells for irrigation. However, the number of wells used for this purpose and the quantity of water used for irrigation is unknown.

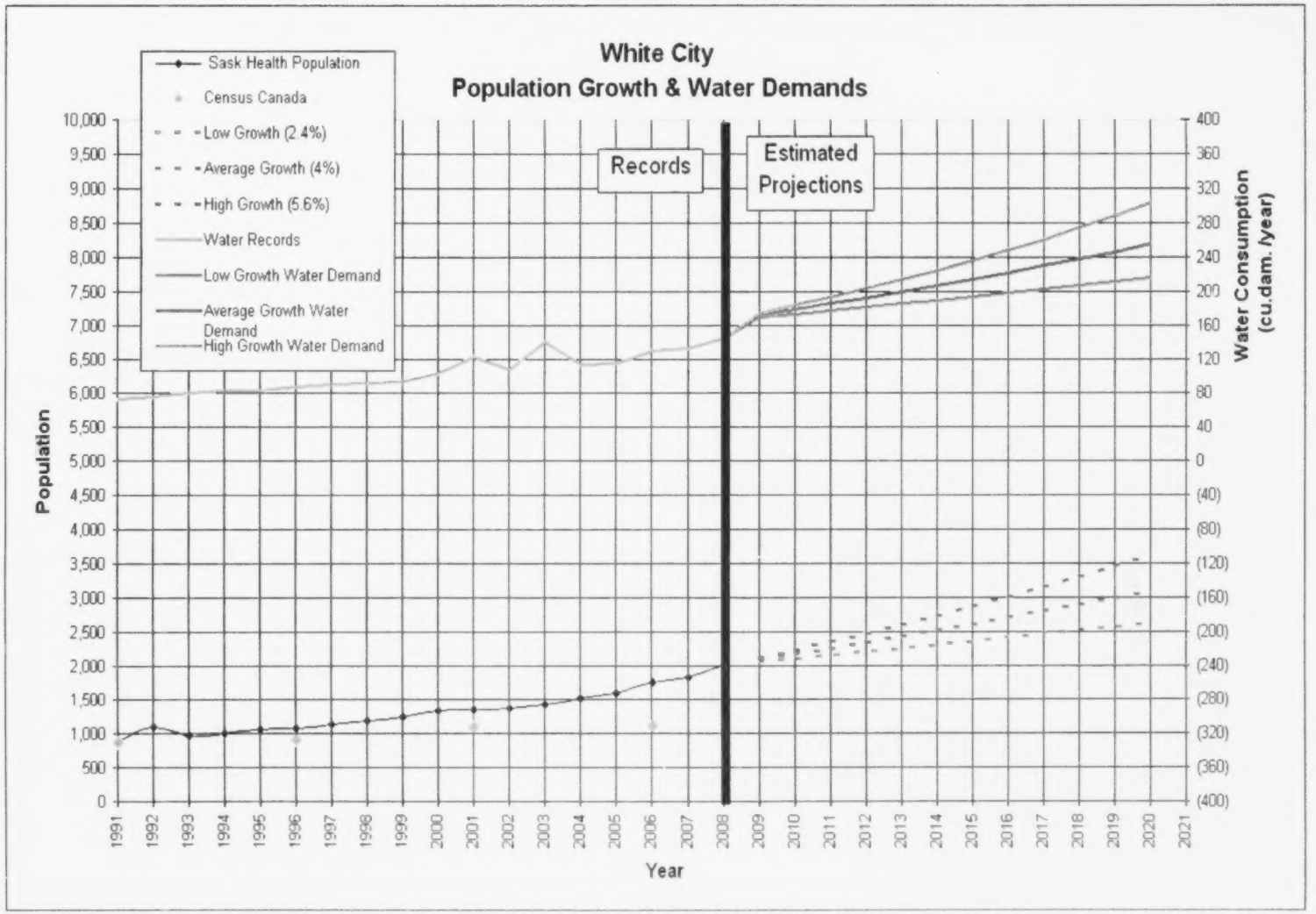


Figure 3.4 - Population and Water Demands for the Town of White City

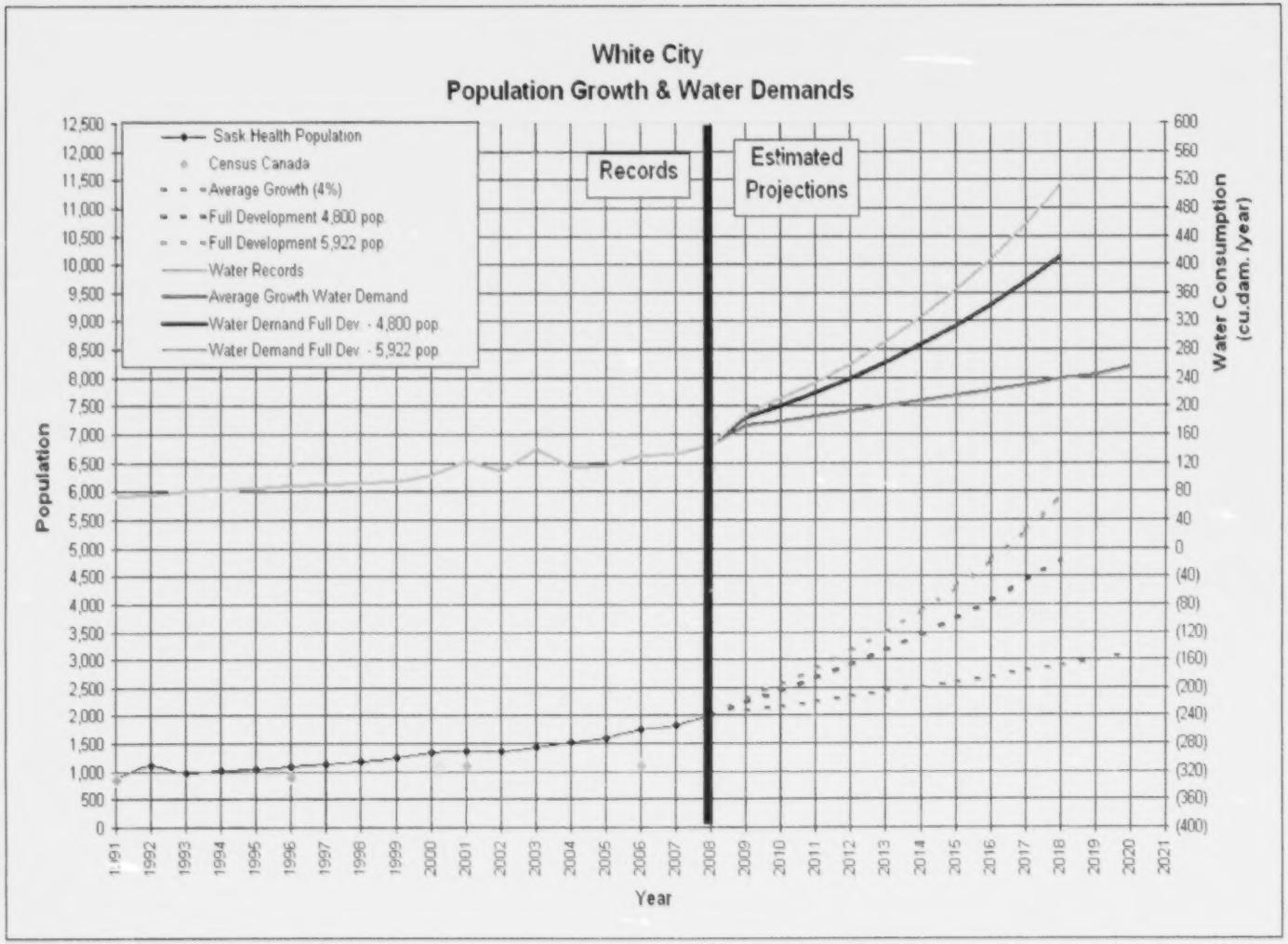


Figure 3.5 - Population and Water Demands for the Town of White City at Full Development

3.6 Emerald Park

As reported by SaskWater, Emerald Park has grown from 644 people in 1996 to 1,417 habitants in 2008. No new major developments are currently planned in Emerald Park, therefore the base growth rates were used to estimate future populations. Population growth projections for Emerald Park for the next ten years are shown in **Table 3.11.**

Table 3.11 - Population Projections for Emerald Park

Year	Low (1%)	Average and High (3%)
2012	1,446	1,595
2015	1,490	1,743
2020	1,566	2,021

Water records for Emerald Park for the last three years were provided by SaskWater. The water consumption is estimated at 357 L/c/d. An average of 400 L/c/d is used to estimate future demands for Emerald Park. Water demand projections for the next ten years are shown in **Table 3.12.**

Table 3.12 - Projected Water Demands for Emerald Park

Year	Low (1%) (cu.dam/year)	Average and High (3%) (cu.dam/year)
2008		173.8 *
2012	211.1	232.9
2015	217.5	254.5
2020	228.6	295.0

* Last year's water demands recorded.

The combined water demands for the Town of White City and Emerald Park are summarized in **Table 3.13.**

Table 3.13 - Combined Water Demands for the Town of White City and Emerald Park

Year/Growth Rate	Town of White City (cu.dam/year)	Emerald Park (cu.dam/year)	Total (cu.dam/year)
2008	144.5 *	173.8 *	318.3 *
2012 / Low	181.9	211.1	393.0
2012 / Medium	193.1	232.9	426.0
2012 / High	204.5	232.9	437.4
2015 / Low	194.5	217.5	412.0
2015 / Medium	215.2	254.5	469.7
2015 / High	236.7	254.5	491.2
2020 / Low	216.7	228.6	445.3
2020 / Medium	256.4	295.0	551.5
2020 / High	303.6	295.0	598.6.0
Full Development	411.1 – 513.0**	295.0	706.1 – 808.0

* Last year's records of water demand.

** White City's full development water demand by 2018.

SaskWater currently has a license to use ground water with a total allocation of no more than 438.0 cu.dam/year. However, an application has been submitted to increase the allocation to 700 cu.dam/year. Based on the existing demands, SaskWater is currently using 72% of its allocation.

Water demand records and water demand projections for Emerald Park for the next ten years are shown in **Figure 3.6.**

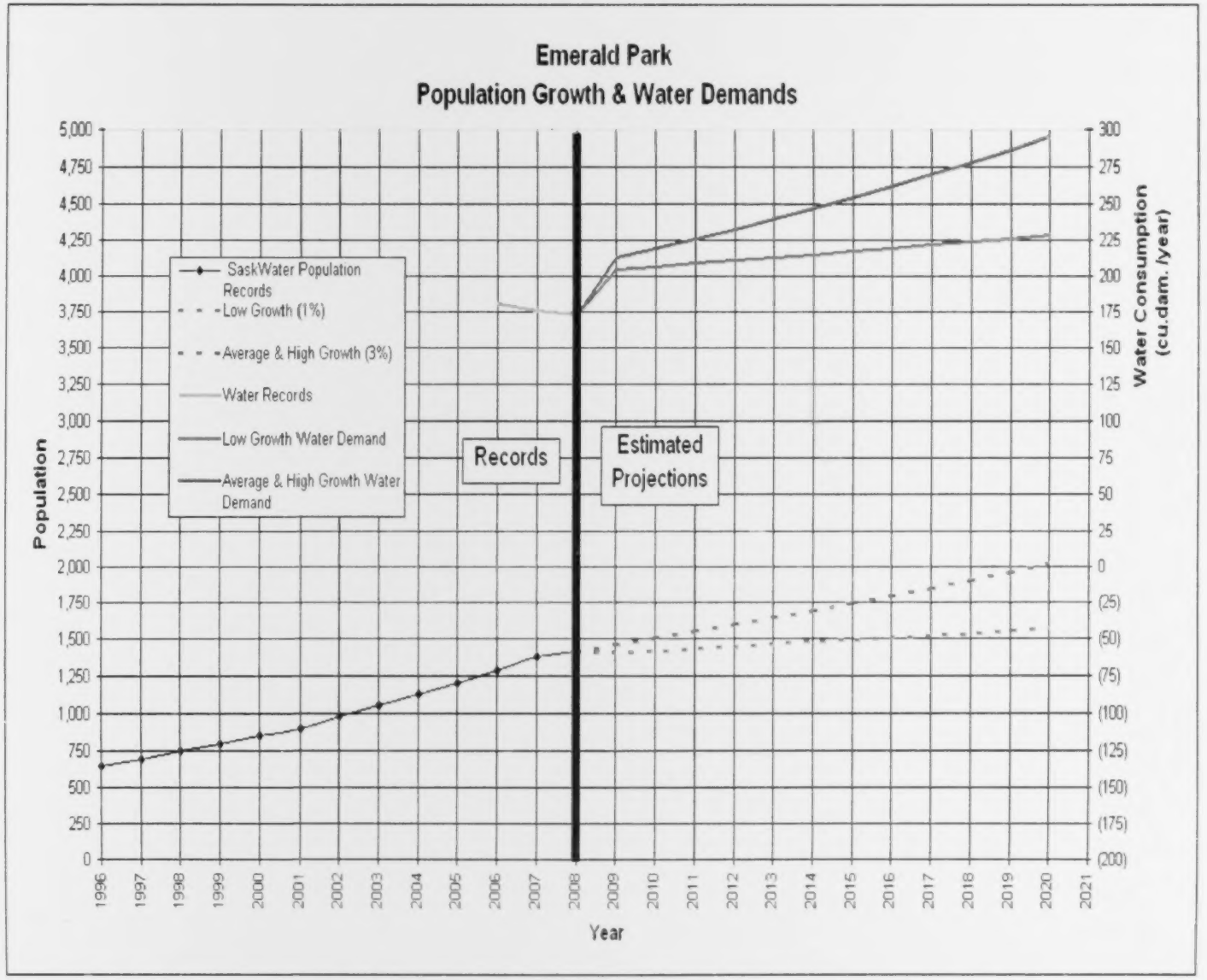


Figure 3.6 - Population and Water Demands for Emerald Park

3.7 Rural Municipalities

The population for the RM of Edenwold includes the residents in Emerald Park plus rural residents. The net rural population for the RM of Edenwold was calculated based on Saskatchewan Health Covered population less Emerald Park's population, as provided by SaskWater. While the population for Emerald Park has increased, the rural population for the RM of Edenwold has decreased from 1,562 in 2002 to 1,426 in 2008.

The RM is in the final stages of developing an "Official Community Plan". Eight new developments are planned in the next five to eight years for a total of 841 new residential lots. In addition, North Ridge Developments has confirmed a new 450 lot development is also planned to be completed within the next eight years. The total number of new residential lots in the RM is planned to be 1,291 within the next eight years. Based on a population density of 3.1 per lot, the 1,291 new lots represent a potential increase of 4,000 new residents.

New developments planned by the RM in 2009 include:

- Stone Point Estates will provide 67 new residential lots plus 6 commercial lots
- Mission Point Estates will provide 30 new residential lots

The Official Community Plan also contemplates construction of a new water treatment plant north of White City. The new water treatment plant will provide treated water to six potential new developments. The RM predicts the proposed developments will provide for growth until the year 2017.

Population growth projections for the RM of Edenwold for the next ten years are shown in **Table 3.14.**

Table 3.14 - Net Rural Population Projected for the RM of Edenwold

Year	Low (-3.2%)	Average (-1.4%)	High (0.3%)	Development Plans (17.4%)
2012	1,253	1,347	1,442	3,426
2015	1,131	1,289	1,455	4,926
2020	937	1,195	1,476	5,426*

* Development plan population is expected to be reached in 2017.

Water demand for drinking water purposes for rural dwellings was estimated to be between 250 L/c/d to 350 L/c/d, with an average of 300 L/c/d. The estimated water demand for the RM's rural population is shown in **Table 3.15.**

Table 3.15 - Projected Water Demand for RM's Rural Population

Year	Low (-3.2%) (cu.dam/year)		Average (-1.4%) (cu.dam/year)		High (0.3%) (cu.dam/year)		Development Plans (17.4%)(cu.dam/year)	
	Range	Average	Range	Average	Range	Average	Range	Average
2012	114.3-160.0	137.2	122.9-172.0	147.5	131.6-184.2	157.9	312.6-437.6	375.1
2015	103.2-144.5	123.8	117.6-164.7	141.1	132.7-185.9	159.3	449.5-629.3	539.4
2020	85.5-119.7	102.6	109.0-152.6	130.8	134.7-188.5	161.6	495.1-693.2 *	594.1 *

* Development plan water demand is expected to be reached in 2017.

Water for any new developments in the RM of Edenwold may be supplied from a new water treatment plant and a centralized distribution system. The source of raw water for the proposed water treatment plant is unknown. However, if ground water is used, the Zehner Aquifer is the most likely water source to be used. An average of 300 L/c/d has been used for water demand in the future developments within the RM and is assumed to be withdrawn from the Zehner Aquifer.

If all the developments planned are completed by 2017, the total water demand required by the RM's rural population is estimated to be between 495.1 and 693.2 cu.dam/year. Although North Ridge Developments has requested a separate aquifer allocation, they have indicated a preference to supply water to their new development from other stakeholder's facilities, including SaskWater wells or the RM's proposed water treatment plant.

The RM of Edenwold does not currently have a license to withdraw water from either of the aquifers.

3.8 City of Regina

The City has discontinued using ground water as a daily source of drinking water. The City maintains several wells for emergency purposes and for irrigation of the Tor Hill and Murray Golf Courses. Since 2005, the City has reduced its number of active wells from 27 to 9. **Table 3.16** summarizes the information for the City's remaining active wells.

Table 3.16 - City of Regina Active Well Summary

Well ID	Year Constructed	Rate of Diversion (cu.dam/year)	Pump Rate (cu.dam/year)	Aquifer	Comments
166	1930	331.1	378.4	Condie	Irrigation
166A	2002	788.4	788.4	Condie	Irrigation
BC6	1982	1,671.4	1,734.4	Zehner	Emergency – Standby
BC7	1986	1,198.3	977.6	Zehner	Emergency – Standby
BC8	1996	1,797.5	1,797.5	Zehner	Emergency – Standby
BC9	1996	1,419.1	1,419.1	Zehner	Emergency – Standby
W6	1991	2,585.9	2,585.9	Regina	Emergency – Standby
W7	1991	1,797.5	1,797.5	Regina	Emergency – Standby
W8	1991	1,986.7	1,986.7	Regina	Emergency – Standby

Ground water use records for the last two years were provided by the City of Regina. The average water use for this period is 47.8 cu.dam/year from the Condie Aquifer. The City has a current total ground water allocation of 1,800 cu.dam/year: 300 from the Condie Aquifer and 1,500 cu.dam/year from the Zehner Aquifer. As requested by Saskatchewan Watershed Authority a value of 1,500 cu.dam/year is used for the City's future ground water demand projections

Water demand projections for the City of Regina are shown in **Table 3.1.**

Table 3.17 - Estimated Water Demand for the City of Regina

Year	Estimated Water Demand (cu.dam/year)
2008	54.6*
2012	1,500.0
2015	1,500.0
2020	1,500.0

* Last year of water demand records.

The City is currently using 18.2% of the total annual allocation of 300 cu.dam/year from the Condie Aquifer and 0% of the ground water allocation from the Zehner Aquifer.

3.9 Clear Vistas Community

Clear Vistas Community is proposing a new development south of Emerald Park and White City, approximately 10 kilometres east of Regina. Clear Vistas is planning to develop up to 303.52 hectares. The concept plan foresees approximately 225 hectares for residential development and 80 hectares for green space.

The concept plan potentially includes commercial, educational and recreational facilities in addition to residential developments. The concept plan also provides for several office towers ranging from 4,650 m^2 to 9,300 m^2 (50,000 to 100,000 $ft.^2$), each to be built in the next ten years or more. The concept plan includes provision for a centralized water pump station and a piping network for drinking water distribution.

According to the developer, Clear Vistas is expected to have a total number of residential lots somewhere between 3,500 and 4,000 and will include single detached and multifamily dwellings. Based on a population density of 3.1 habitants per residence, the estimated population of Clear Vistas would be in the range of 10,850 to 12,400 people. The development plan provides for an average of 250 lots per year, including single and multifamily buildings.

Population growth projections for the next ten years are shown in **Table 3.18.** Clear Vistas is expected to start construction in 2010, pending federal and provincial approvals.

Table 3.18 - Population Projections for Clear Vistas

Year	Population
2012	2,300
2015	5,750
2020	11,500
Full Development	12,400

The developer has indicated ground water will likely be used, at least for the early stages of development. However, Clear Vistas does not currently have a license to withdraw ground water. The first stage could include as many as 1,500 developed lots (4,650 residents). The aquifer most likely to be used is the Zehner Aquifer. Over the long term, the developer is also contemplating using other sources to supply water. However, these plans are still in the conceptual phase.

For new developments, design practice is typically to use 454 L/c/d to estimate water demand. However, rural type developments typically have less industrial developments so a lower water demand rate is sometimes used. For purposes of this study, three water demand rates were used to provide a range of possible water consumption for the new community. Water demand allocation projections for the Clear Vistas Community for the next ten years are shown in **Table 3.19.**

Table 3.19 – Estimated Water Demand for Clear Vistas

Year	350 L/c/d (cu.dam/year)	400 L/c/d (cu.dam/year)	454 L/c/d (cu.dam/year)
2012	293.8	335.8	381.1
2015	734.6	839.5	952.8
2020	1,469.1	1,679.0	1,905.7
Full Development	1,584.1	1,810.4	2,054.8

The first 4,650 habitants (1,500 residential lots) are anticipated to require ground water as their main water source. If the development projections come to fruition, the number is expected to be reached in 2014 with an estimated water demand of between 587.7 and 762.3 cu.dam/year. At early stages of development, the per capita consumption rates would be expected to be at the lower end.

Section 4

Summary

4. Summary

4.1 Population Projections

The population in the Regina East Area was estimated to be 8,945 in 2008, excluding the City of Regina. The breakdown according to the existing communities is shown in **Figure 4.1**.

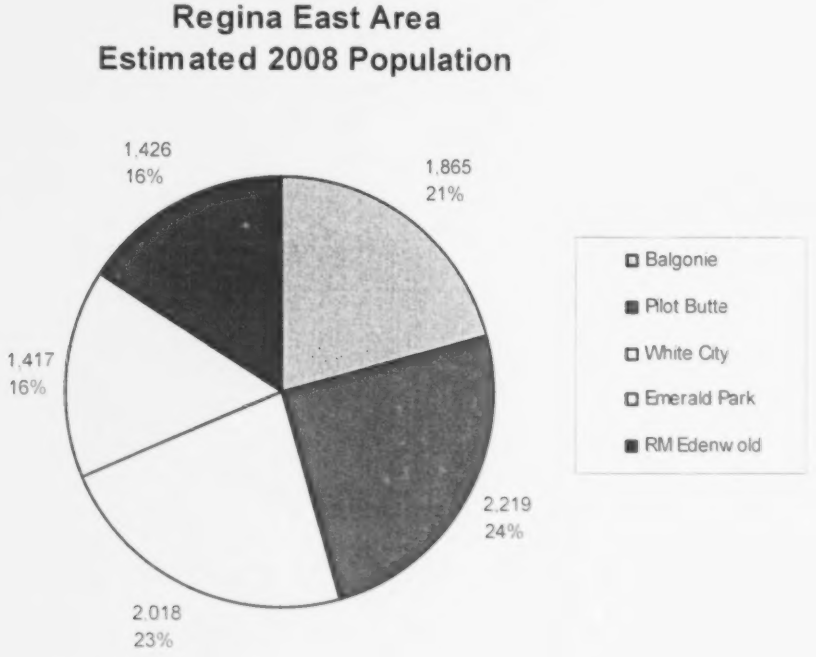


Figure 4.1 - Estimated 2008 Population Breakdown

Four different scenarios were developed to estimate the Regina East Area's population for the next ten years. The scenarios are:

- Low Growth
- Average Growth
- High Growth
- Proposed Development Growth

The low, average and high base growth scenarios were developed based on the statistical analysis of each community. In addition, new developments planned in the area have been added where applicable. Major developments are planned within the next ten years or less for the Town of Pilot Butte, the RM of Edenwold,

the Town of White City and Clear Vistas Community. The average base growth rate was used for the remaining communities including the Town of Balgonie and Emerald Park.

Table 4.1 summarizes the population projections for the Regina East Area for the different scenarios for the next ten years.

Table 4.1 - Total Population Projections for Regina East Area

Scenario/Year	Balgonie	Pilot Butte	White City	Emerald Park	RM of Edenwold	Clear Vistas	Totals
Low Base Growth Rate							
2012	2,056	2,246	2,215	1,446	1,253		**9,216**
2015	2,205	2,267	2,368	1,490	1,131		**9,461**
2020	2,468	2,301	2,638	1,566	937		**9,910**
Average Base Growth Rate							
2012	2,094	2,291	2,351	1,595	1,347		**9,678**
2015	2,275	2,346	2,620	1,743	1,289		**10,273**
2020	2,598	2,438	3,110	2,021	1,195		**11,362**
High Base Growth Rate							
2012	2,140	2,336	2,490	1,595	1,442		**10,003**
2015	2,362	2,425	2,882	1,743	1,455		**10,867**
2020	2,759	2,579	3,627	2,021	1,476		**12,462**
Proposed Developments							
Scenario/Year	**Balgonie**	**Pilot Butte (Incl. North Ridge Dev.)**	**White City**	**Emerald Park**	**RM of Edenwold (Incl. North Ridge Dev.)**	**Clear Vistas**	**Totals**
2012	2,094 [1]	2,874	2,914 – 3,154	1,595 [1]	3,426	2,300	**15,203 – 15,443**
2015	2,275 [1]	3,434	3,745 - 4,301	1,743 [1]	4,926	5,750	**21,873 – 22,429**
2020	2,598 [1]	4,538	4,800 - 5922 [5]	2,021 [1]	5,426 [4]	11,500	**30,883 – 32,005**
All Developments Completed	3,065 [3]	7,940 [3]	4,800 – 5,922 [5]	2,021 [2]	5,426 [4]	12,400 [3]	**35,652 – 36,774**

1. Denotes average growth population.
2. Denotes estimated population for 2020 under average growth rate.
3. Denotes final population based on developments plans. Year of completion varies according to each community.
4. Denotes population to be reached in 2017 as per RM's development plans.

5. Denotes population to be reached in 2018 as per Town's growth rate expectations.

If all development plans proceed as predicted, the total population in the Regina East Area could exceed 30,000 by 2020. At full build-out of all proposed developments, the population in the area is projected to be around 36,000.

4.2 Water Allocation Summary

The current allocation for each major stakeholder from the Zehner and Condie aquifers is summarized in **Table 4.2**.

Table 4.2 – Aquifer Water Withdrawal Allocation (cu.dam/year)

Community	Zehner Aquifer	Condie Aquifer	Total
City of Regina	1,500 [1]	300 [1]	1,800
Town of Balgonie	318 [2]	0	318
SaskWater (Town of White City and Emerald Park)	438 [3]	0	438
Town of Pilot Butte	0 [4]	0	0
RM of Edenwold	0 [5]	0	0
Total	**2,256**	**300**	**2,556**

Notes:

1. The City of Regina values are currently higher but are planned to be revised as shown.
2. The Town of Balgonie has requested an increase in the allocation to 400 cu.dam/year.
3. SaskWater has requested an increase in the allocation for the Town of White City and Emerald Park to 700 cu.dam/year.
4. The Town of Pilot Butte has requested an allocation of 800 cu.dam/year.
5. The RM of Edenwold has requested an allocation of 400 cu.dam/year.

4.3 Water Demand Summary

In 2008, the estimated volume used by all the users of the Regina East Aquifer system is estimated to be 985.7 cu.dam/year. **Figure 4.2** shows the estimated percentages used by each user in 2008.

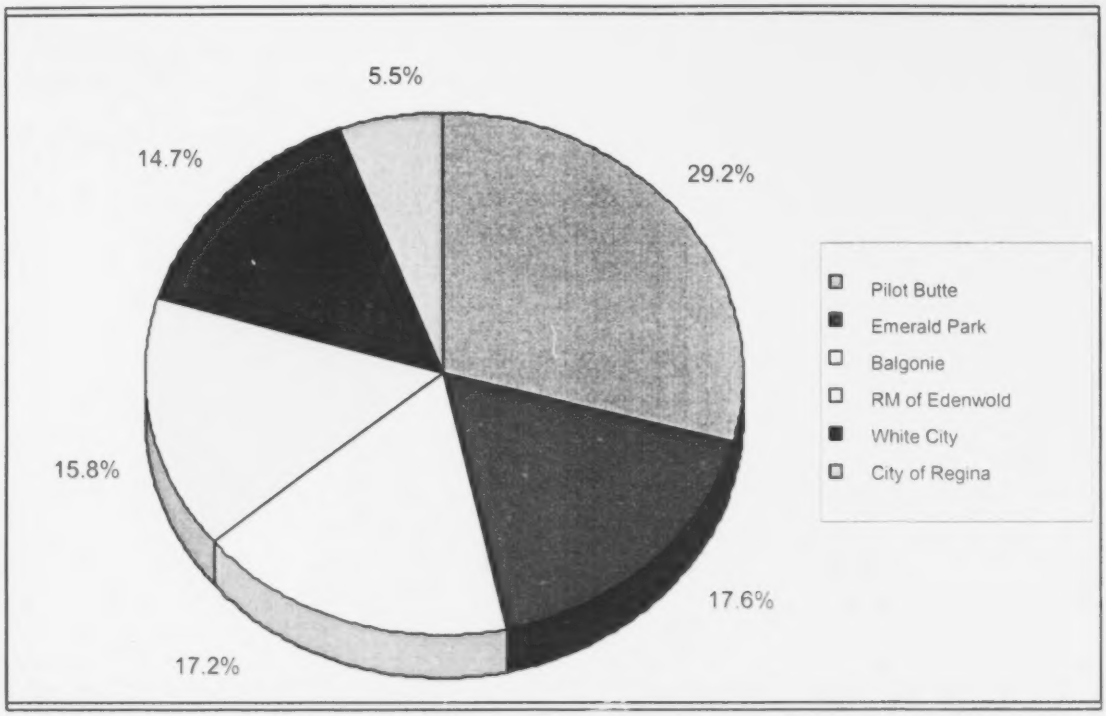


Figure 4.2 – 2008 Estimated Water Use Breakdown from the Regina East Aquifer System

Table 4.3 summarizes the projected water demands under the different scenarios for the next ten years and at the completion of all developments.

Based on population base growth rates, water demands in 2020 are projected to be between 2,564.8 and 2,978.8 cu.dam/year. However, if all developments are completed according to the developers' timelines, total water demand in the Regina East Area is projected to be between 5,095.0 and 5,831.1 cu.dam/year by the year 2020. Water demands with all developments fully completed are projected to be between 5,711.2 and 6,481.9. However, the timing when full development occurs is not known. Ground water demands could be less than those mentioned above if other water sources, other than the aquifer system, are used.

Table 4.3 - Water Demands Summary for the Regina East Area Aquifers Systems

Scenario/Year	Balgonie (cu.dam/year)	Pilot Butte (cu.dam/year)	White City (cu.dam/year)	Emerald Park (cu.dam/year)	Rural Population of RM of Edenwold (cu.dam/year)	City of Regina (cu.dam/year)	Clear Vistas (cu.dam/year)	Totals (cu.dam/year)	
								Range	Average
Low Growth									
2012	266.4	291.1	181.9	211.1	114.3 – 160.0	1,500		**2,564.8– 2,610.5**	**2,587.7**
2015	285.7	293.7	194.5	217.5	103.2 - 144.5	1,500		**2,594.6 – 2,635.9**	**2,615.3**
2020	319.8	298.2	216.7	228.6	85.5-119.7	1,500		**2,648.8 –2,683.0**	**2,665.9**
Average Growth									
2012	271.3	296.8	193.1	232.9	122.9 - 172.0	1,500		**2,617.0–2,666.1**	**2,641.6**
2015	294.8	303.9	215.2	254.5	117.6 - 164.7	1,500		**2,686.0 – 2,733.1**	**2,709.6**
2020	336.6	315.9	256.4	295.0	109.0 - 152.6	1,500		**2,812.9 – 2,856.5**	**2,834.7**
High Growth									
2012	277.3	302.7	204.5	232.9	131.6 - 184.2	1,500		**2,649.0 – 2,701.6**	**2,675.3**
2015	306.0	314.3	236.7	254.5	132.7 - 185.9	1,500		**2,744.2 – 2,797.4**	**2,770.8**
2020	357.5	334.2	303.6	295.0	134.7 - 188.5	1,500		**2,925.0 – 2,978.8**	**2,951.9**
Proposed Developments Growth									
Scenario/Year	**Balgonie (cu.dam/year)**	**Pilot Butte (Incl. North Ridge Dev.) (cu.dam/year)**	**White City (cu.dam/year)**	**Emerald Park (cu.dam/year)**	**Rural Pop. of RM of Edenwold (Incl. North Ridge Dev.) (cu.dam/year)**	**City of Regina (cu.dam/year)**	**Clear Vistas (cu.dam/year)**	**Totals Range (cu.dam/year)**	**Totals Average (cu.dam/year)**
2012	271.3 [1]	372.4	239.3 – 260.4 [6]	232.9 [1]	312.6 – 437.6	1,500	293.8 - 381.1	**3,222.3 – 3,455.7**	**3,339.0**
2015	294.8 [1]	444.1	314.3 – 365.1 [6]	254.5 [1]	449.5 – 629.3	1,500	734.6 – 952.8 [5]	**3,991.8 – 4,440.6**	**4,216.2**
2020	336.6 [1]	588.1	411.1 – 513.0 [6]	295.0 [1]	495.1 – 693.2	1,500	1,469.1 – 1,905.7 [5]	**5,095.0 – 5,831.1**	**5,463.1**
All Developments Fully Completed	**397.1** [3]	**1,028.8** [3]	**411.1 – 513.0** [6]	**295.0** [2]	**495.1 – 693.2** [4]	1,500	**1,584.1 – 2,054.8** [3,5]	**5,711.2 – 6,481.9** [3,5]	**6,096.6** [3,5]

1. Denotes average growth water demand.
2. Denotes estimated water demand for 2020 under average growth rate.
3. Denotes final water demand based on development plans. Year of completion varies according to each community.
4. Denotes water demand to be reached in 2017 as per RM's development plans.
5. Denotes total water demand for Clear Vistas based on population projections.
6. Denotes population to be reached in 2018 as per Town's growth rate expectations.

Section 5

Water Conservation

5. Water Conservation

5.1 Water Conservation

Many municipalities have implemented water conservation measures. Some have been through legislation and others through public education. With continued growth in the Regina East Area, the capacity of the Condie and Zehner Aquifers to provide a sustainable and quality source of water will eventually reach the limit. Ultimately, the capacity to supply a good quality and reliable source of water will affect the ability of the communities to grow.

Some common measures identified by Environment Canada that can be implemented to promote water conservation include (http://www.ec.gc.ca/WATER/en/manage/effic/e_solm.htm):

Structural

- Metering
- Water recycling systems
- Wastewater reuse
- Flow control devices
- Distribution system pressure reduction
- Water saving devices (efficient fixtures, appliances and retrofits)
- Drought resistant landscaping (xeriscaping)
- Efficient sprinkling/irrigation technology
- New process technologies
- Treatment plant improvements

Operational

- Leak detection and repair
- Water use restrictions
- Elimination of combined sanitary/storm sewers to reduce loadings on sewage treatment plants
- Treatment plant improvements

Economic

- Rate structures
- Pricing policies
- Incentives through rebates and tax credits
- Other sanctions (fines)

Socio-political

- Public education
- Information transfer and training
- Regulatory (legislation, codes, standards and bylaws)

Education is an integral component of the implementation of any long term program. A water education plan is intended to set objectives and strategies to engage local government and communities to preserve ground water for future generations. The education program should be focused on:

- Importance of ground water
- Awareness of aquifers' sensitivity to ecosystem changes (i.e. aquifer protection)
- Engage people to learn and have an active role to reduce water demands, understand ground water supply and cycle, protection of ground water sources and the use of alternative water sources

Water conservation initiatives are focused on practical ways to reduce water consumption. Initiatives can be as simple as a list of recommended practices, up to the implementation of bylaws, including financial incentives to promote water conservation.

Previous studies of the benefits of reducing water consumption through financial incentives show some financial incentives can be cost effective in the long term. Understanding water consumption behaviour is a key element to target effective water conservation strategies.

Reducing water consumption in the bathroom and the laundry room may have a significant impact on the overall water demand. The typical Canadian house uses approximately 250 L/c/d, with 65% of the water being used, going to wastewater. A typical breakdown of residential water use is shown in **Figure 5.1**.

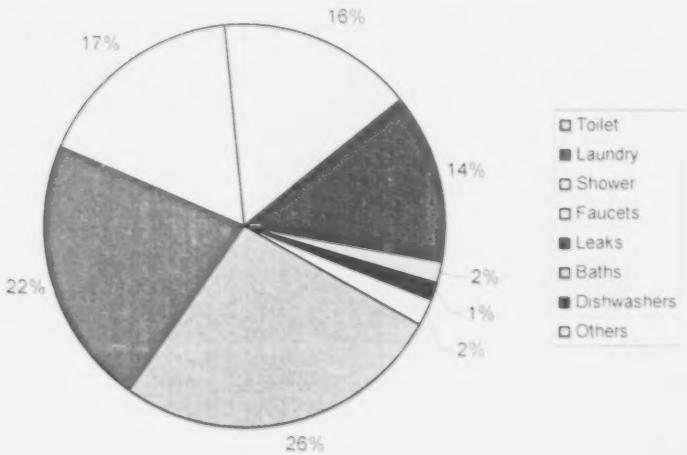


Figure 5.1 - Typical Residential Water Use

Studies have also shown up to 55% of residential water consumption may be used for watering lawns and other landscaping uses. A number of wells in the Regina East Area are currently being used for irrigation purposes. The number of wells used for this purpose should be confirmed and this practice should be discouraged. Encouraging the use of xeriscaping, including the use of native plant species in landscaping, can also help reduce the volume of water used for landscaping purposes.

Many of the users in the Regina East Area with private wells do not have any water meters to allow for monitoring of water use and also do not pay for water. Studies have shown installing water meters and initiating a charge for water consumption encourages water conservation. For communities with an existing distribution system, leakage from buried pipes may also be a significant component of water loss.

The following is a list of water saving initiatives and standard water saving suggestions used by some other Canadian jurisdictions:

- Low-flow toilet rebate program - already in place by Saskatchewan Watershed Authority.
- Water saving kit - free of charge to residents (1 kit per property or unit). Water efficiency kits consisting of a water efficient showerhead, 1 or more faucet aerator and a toilet displacement plastic bag – City of Ottawa.
- High-efficiency, front-loading washing machine rebate program – City of Toronto.
- Free landscape advisor for water saving and efficient gardening – City of Toronto.
- Subsidize rain barrels for rainwater harvesting to watering plants in and around the house – City of Chilliwack.
- Timing restrictions bylaw for the use of sprinklers systems - City of Chilliwack.
- Cash incentives for business and industries which reduce water consumption if compared with previous years – City of Toronto.
- Subsidies for the retrofit of process equipment to become more water efficient (e.g. water chillers) - City of Ottawa.
- The City of Regina has also initiated a number of water saving strategies. Additional information can be found at the City of Regina's website at www.regina.ca.

Development and building standards can also be used to guide developers and builders to incorporate more water efficiency into facilities as well as protect the aquifers.

Based on previous experience in various communities, a reduction in water consumption of 20% is achievable. The impact on water withdrawn from the Regina Area Aquifers is shown in **Table 5.1.**

Table 5.1
Comparison of the Regina East Average Water Demands with and without Conservation Methods

Year	Without Conservation Methods (cu.dam/year)	With Conservation Methods (cu.dam/year)
2009	2,578.2	2,062.6
2010	2,598.8	2,079.0
2011	2,620.0	2,096.0
2012	2,641.6	2,113.3
2013	2,663.7	2,131.0
2014	2,686.4	2,149.1
2015	2,709.6	2,167.7
2016	2,733.2	2,186.6
2017	2,757.5	2,206.0
2018	2,782.4	2,225.9
2019	2,806.5	2,245.2
2020	2,834.7	2,267.8
Full Development	6,209.7	4,967.8
Total	**38,622.3**	**30,897.8**

Greywater is defined as the wastewater coming from sinks, kitchens, laundry, showers and tubs. Effluent from these fixtures are typically collected through a separate plumbing system and treated to comply with health safety, aesthetics and environmental requirements before reuse. Treatment processes vary according to the greywater characteristics and the water quality required for its reuse. Greywater reuse is typically not intended to be reused as potable water.

Canadian regulatory agencies are in the early stages of regulating greywater systems. Some regulatory agencies mandate that only potable water be used for the toilet and sinks, limiting greywater use. Greywater systems are subject to local codes and could require special permits from plumbing officials and in some cases, public health officials for their installation. However, some jurisdictions in the USA, such as Arizona and California, have been able to implement regulations with some type of restrictions for this type of system.

Section 6

Conclusions and Recommendations

6. Conclusions and Recommendations

6.1 Conclusions

- The total estimated future population in the Regina East Area including proposed new developments are summarized in **Table 6.1**.

Table 6.1 – Population Summary for the Regina East Area for the Next 10 Years

Year	Low	Average	High	Development Plans
2012	9,216	9,678	10,003	**15,203 – 15,443**
2015	9,461	10,273	10,867	**21,873 – 22,429**
2020	9,910	11,362	12,462	**30,883 – 32,005**
Full Development	N/A	N/A	N/A	**35,652 – 36,774**

N/A – Not Applicable

- If proposed developments in the area are completed, the estimated population by 2020 is estimated to be 31,500. At full build-out of all proposed developments, the population in the Regina East Area could potentially be around 36,000.

- The current allocation for each major stakeholder from the Zehner and Condie aquifers is summarized in **Table 6.2**.

Table 6.2 – Aquifer Water Withdrawal Allocation (cu.dam/year)

Community	Zehner Aquifer	Condie Aquifer	Total
City of Regina	1,500 [1]	300[1]	1,800
Town of Balgonie	318	0	318
SaskWater (Town of White City and Emerald Park)	438	0	438
Town of Pilot Butte	0	0	0
RM of Edenwold	0	0	0
Total	**2,256**	**300**	**2,556**

1. The City of Regina values are currently higher but are planned to be revised as shown.

- In 2008, Balgonie used 53% of the total ground water allocation of 318 cu.dam/year. The Town of Balgonie has requested an increase in their allocation to 400 cu.dam/year. The current demand allocation of 318 cu.dam/year is expected to be exceeded by around 2018 based on an average growth rate.

- The Town of Pilot Butte does not currently have a license to withdraw ground water. However, the Town is in the process of making an application for funding of a centralized water treatment system and had requested 800 cu.dam/year ground water allocation to service a total population of 4,000. The most likely source of raw water for the proposed water treatment plant is the Zehner Aquifer.

- The Town of White City's water demand is estimated to be 303.6 cu.dam/year by 2020, based on a high growth rate. The water demand at full development within the existing Town's limits is expected to be between 411.1 and 513.0 cu.dam/year.

- SaskWater is using 72% of the ground water allocation of 438 cu.dam/year to supply raw water to Emerald Park and drinking water to White City. SaskWater has requested an increase in the allocation for the Town of White City and Emerald Park to 700 cu.dam/year. Based on estimated growth rates, the current allocation of 438 cu.dam/year may be exceeded in 2013 if White City and Emerald Park grow at an average rate.

- The RM of Edenwold does not currently have a license to withdraw water from the Regina aquifers. However, the RM is planning to build a new water treatment plant including a supply network to provide drinking water to eight possible new developments. The RM has requested an allocation of 400 cu.dam/year to service the proposed developments. All of the RM's development plans are expected to be completed by 2017 with an estimated water demand between 495.1 and 693.2 cu.dam/year.

- The City of Regina maintains seven wells for emergency purposes and two for irrigation of the Tor Hill and Murray Golf Courses, with no plans to increase its existing ground water demand. The City has the highest allocation in the Regina area for a total of 1,800 cu.dam/year from both the Condie and Zehner Aquifers. The City is currently using 18.2% of the Condie Aquifer allocation and 0% from the Zehner Aquifer ground water allocation.

- Clear Vistas Community is a proposed new development with an estimated number of residential lots between 3,500 and 4,000. The first stage will use ground water as the water source and could include as many as 1,500 residential lots (4,650 residents). The aquifer most likely to be used is the Zehner Aquifer. If the development projections come to fruition, the first stage is expected to be reached in 2014 with an estimated water demand between 587.7 and 762.3 cu.dam/year.

- The total estimated water demands in the Regina East Area are summarized in **Table 6.3**. The total demands are based on an average base growth rate plus all proposed new developments.

Table 6.3 – Water Demands Summary for the Regina East Area

Year	Estimated Total Water Demand Range (cu.dam/year)	Estimated Total Water Demand Average (cu.dam/year)
2012	3,222.3 – 3,455.7	3,339.0
2015	3,991.8 – 4,440.6	4,216.2
2020	5,095.0 – 5,831.1	5,463.1
Full Developments	5,711.2 – 6,481.9	6,096.6

6.2 Recommendations

The following recommendations are provided for consideration:

- Establish an education program to:
  - Encourage water conservation
  - Encourage aquifer protection
- Establish a regional planning board to coordinate the various developments and ensure consistency of standards between developments.
- Consider a regional water utility to coordinate the supply of water to the various communities.

Clifton Associates, 1989

Appendix A

Regina Aquifer Plan Part A
Allocation Plan, Clifton Associates, 1989

APPENDIX B

HYDROGEOLOGY

B1 Hydrogeologic Setting

The SRC publication "Comprehensive Evaluation of the Groundwater Resources in the Regina Area" (Maathuis and van der Kamp, 1988) is the hydrogeologic reference document for the Regina aquifer management plan. The following paragraphs summarize the hydrogeology as presented in the report.

The stratigraphic setting of the Regina area is illustrated in Figure B.1. The stratigraphic units of interest for this study include the upper Saskatoon Group.

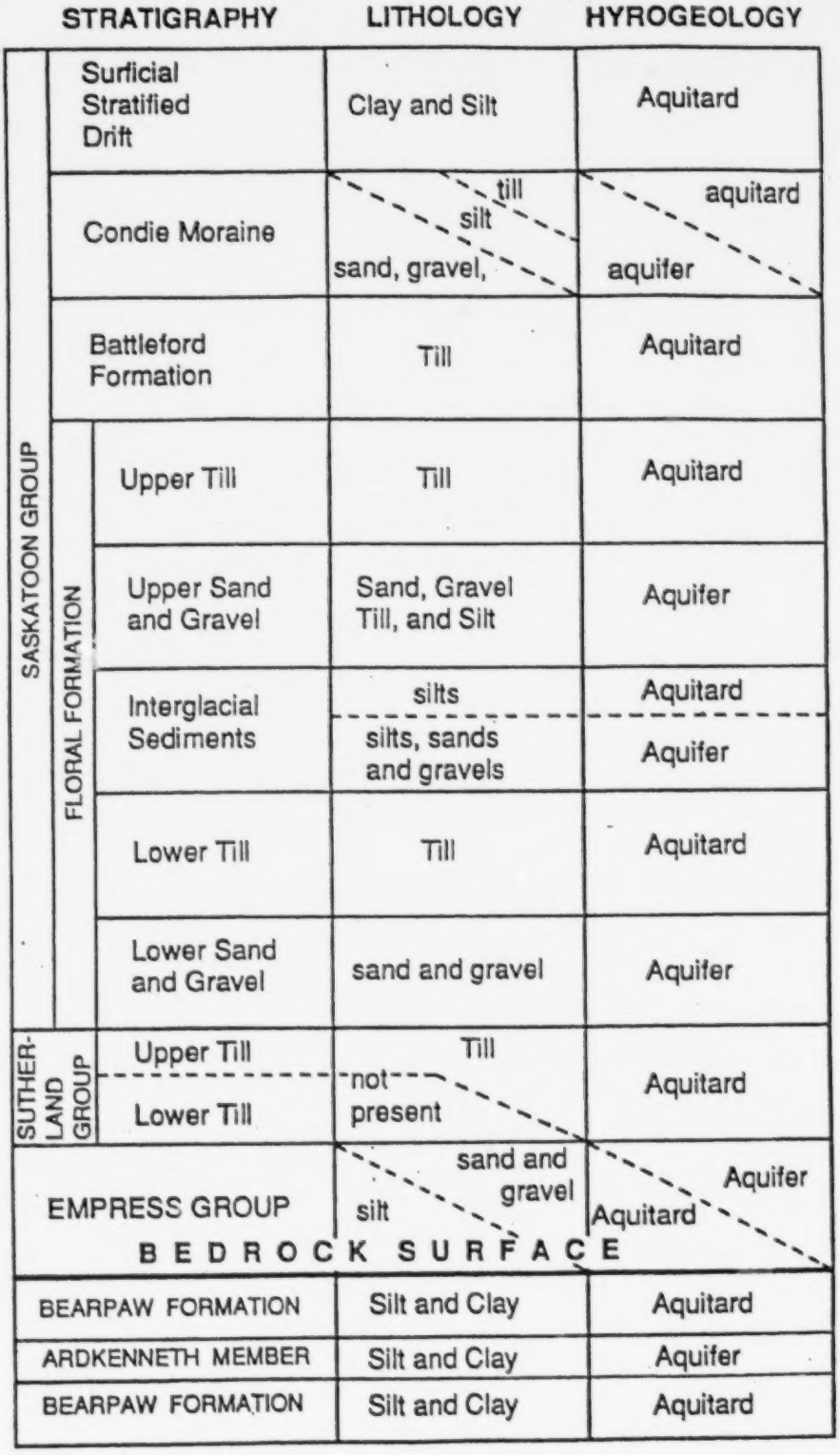
The uppermost unit is the surficial stratified drift which is composed primarily of Regina clay. The clay is present in the Regina area proper and thins and becomes absent to the east and north of the City. The clay is an aquitard. In its intact state, it has a very low hydraulic conductivity and greatly restricts the flow of water. It is however, highly desiccated and contains numerous cracks and fissures which impart a moderate hydraulic conductivity to the strata.

The second strata is the Condie moraine. This geologic unit is composed of a small amount of till, silt and a sand and gravel core. The sand and gravel portion comprises the Condie aquifer. In the central Regina area, the Condie aquifer is overlain with Regina clay; to the east of the City, the Condie aquifer is exposed on surface. Water table conditions are prevalent throughout the aquifer.

The aquifer is subdivided into three portions: west, central and east. The east portion corresponds to those areas where the sand is exposed at surface. The central portion corresponds to those areas which are overlain by Regina clay and contain useable amounts of water. In the western portion, the saturated thickness is very low and the stratum is not a significant aquifer.

The Condie stratum is underlain by till of the Battleford Formation and an upper till of the Floral Formation. Till is a well graded, sandy, silty clay

FILE R826



SCHEMATIC GEOLOGICAL AND HYDROGEOLOGICAL SETTING OF THE REGINA AREA (STRATIGRAPHY AFTER CHRISTIANSEN, 1979)

CLIFTON ASSOCIATES LTD.

FIGURE B.1

material deposited in contact with glacier ice. It is an aquitard. In areas where the Condie aquifer and underlying aquifers are present, recharge from the Condie to the lower aquifers occurs through the till. In the Zehner area, the till is exposed on surface. The surface expression of a till unit is a gently rolling topography with numerous sloughs and potholes.

Sand and gravel stratum within the Floral till unit forms the Regina, Zehner and northern aquifer. The Regina aquifer is comprised of the upper Floral sands and gravels plus hydraulically interconnected, interglacial sediments within the Regina area.

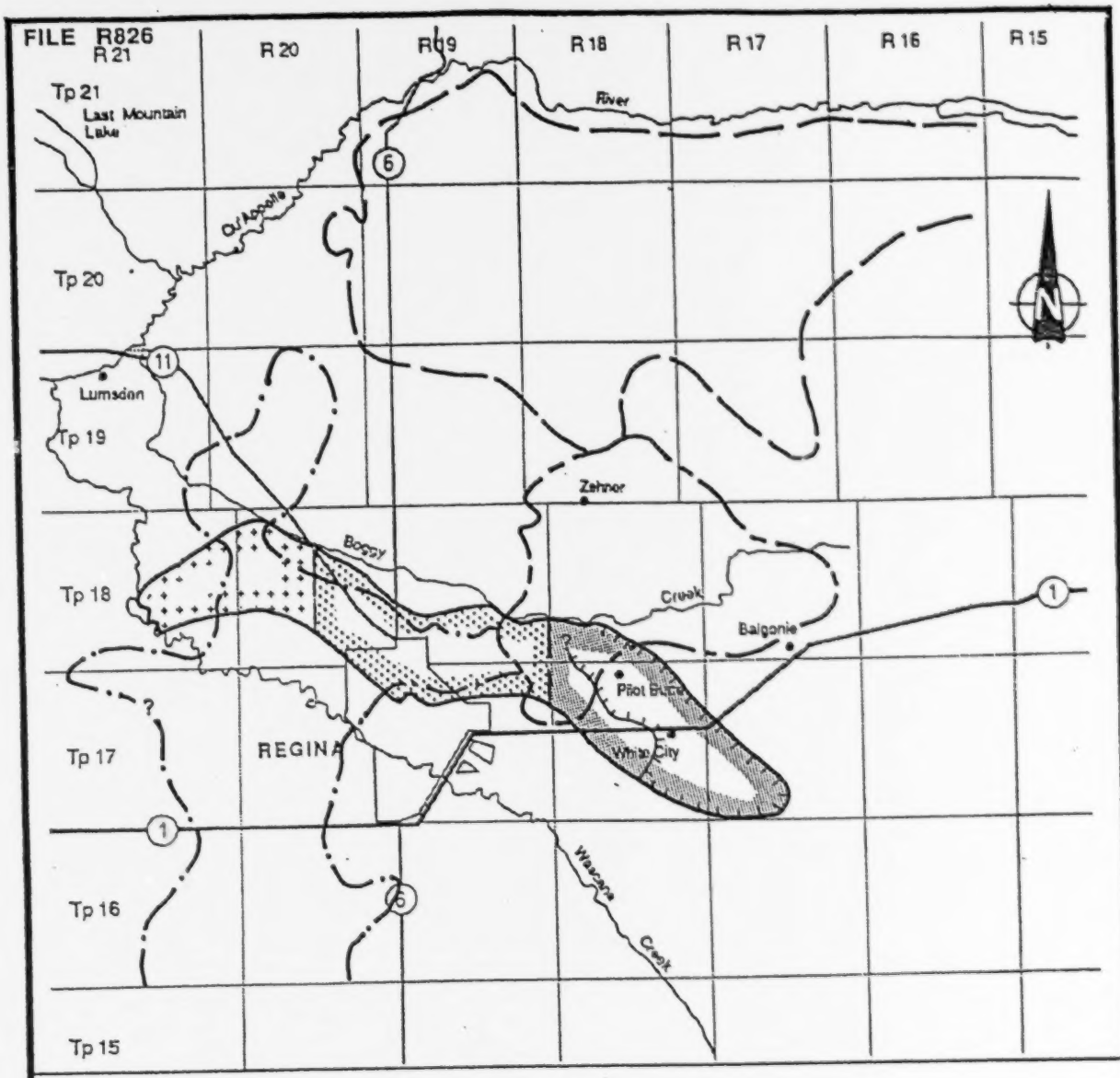
The Zehner aquifer, which is present to the east of the City, is comprised of both the upper and lower sand and gravel units within the Floral Formation. These units are hydraulically interconnected and function as a single aquifer unit. The Zehner aquifer is stratigraphically continuous with the Regina aquifer. However, a hydraulic discontinuity immediately east of the City separates the two aquifers.

The northern aquifer system is comprised of sands and gravels of the Floral Formation. It is stratigraphically continuous with the Zehner aquifer, however the two aquifers are separated on the basis of a groundwater divide.

The areal extent of each of the aquifer units in the Regina area is illustrated in Figure B.2.

B2 Aquifer Management Units

Aquifer management units are practical units defined by hydrogeologic conditions that provide a rational basis for groundwater management. The aquifers as identified by the Saskatchewan Research Council fulfill these objectives. The units have a hydrogeologic basis and have been shown to function more or less as independent units. Changes in withdrawals from one aquifer unit would have a limited effect upon groundwater conditions in the other units.



LEGEND:

CONDIE AQUIFER SYSTEM

WEST SECTION

CENTRAL SECTION

EAST SECTION

OUTCROP OF CONDIE SANDS & GRAVELS

REGINA AQUIFER SYSTEM

ZEHNER AQUIFER SYSTEM

NORTHERN AQUIFER SYSTEM

EXTENT OF REGINA AREA AQUIFERS
(after Maathuis and van der Kamp, 1988)

CLIFTON ASSOCIATES LTD.

FIGURE B-2

The hydraulic interconnections between the aquifer units are shown diagrammatically in Figure B.3. Groundwater flows shown are the range provided by the Saskatchewan Research Council. The 1990 withdrawals from SAEL (1987). All water is derived from infiltration. The SRC estimated infiltration for each aquifer based upon its area, the estimated hydraulic conductivity of the overlying soil, and the average regional precipitation.

The Condie central aquifer has a very small recharge because of the overlying Regina clay soils, good surface drainage with limited opportunities for ponded water, and a relatively small area. Most of the inflow is derived from the Condie east aquifer. This inflow is more or less balanced by an outflow to the Regina aquifer through the till aquitard separating these two units. Groundwater use from the Condie central aquifer is minimal and consists of the City of Regina Well R2, some local irrigation and domestic use.

Strong infiltration occurs into the Condie east aquifer where the Condie sand extends to surface. The water level is controlled by local springs and discharges. Major springs and flowing wells are concentrated along Boggy Creek. The aquifer serves as the present supply for White City and Pilot Butte and the rural population. The aquifer has been a historic supply for CP Rail and a 10 inch infiltration line for the City of Regina.

The Regina aquifer receives a moderate amount of infiltration. This infiltration has likely increased in recent years because of a leakage from the City water and sewer systems, irrigation and the lowering of evapotranspiration with development. Other inflows into the Regina aquifer are lateral flow from the Zehner aquifer to the west, and vertical flow from the Condie central aquifer into the Regina aquifer. Interaction with the surface water system occurs in Boggy Creek immediately downstream of the Condie reservoir and in Wascana Creek near the sewage treatment plant. Active spring discharge occurs in the Boggy Creek area. In the Wascana Creek area, surface water interaction has changed from a historic discharge area to a recharge area as the water levels in the Regina aquifer have dropped. The Regina aquifer is a major source of supply for the City of Regina and the

Consumers' Cooperative Refinery Limited, and historically the Imperial Oil refinery.

Recharge to the Zehner aquifer is primarily from surface infiltration. Natural discharge occurs laterally to the Regina aquifer. There is a strong surface interaction with Boggy Creek. Historically, this was a major discharge; however, with increased pumping it has become a small recharge component. The Zehner aquifer is a source of supply for the City of Regina, Boggy Creek and Mallory springs well fields, the Town of Balgonie and the R.M. of Edenwold.

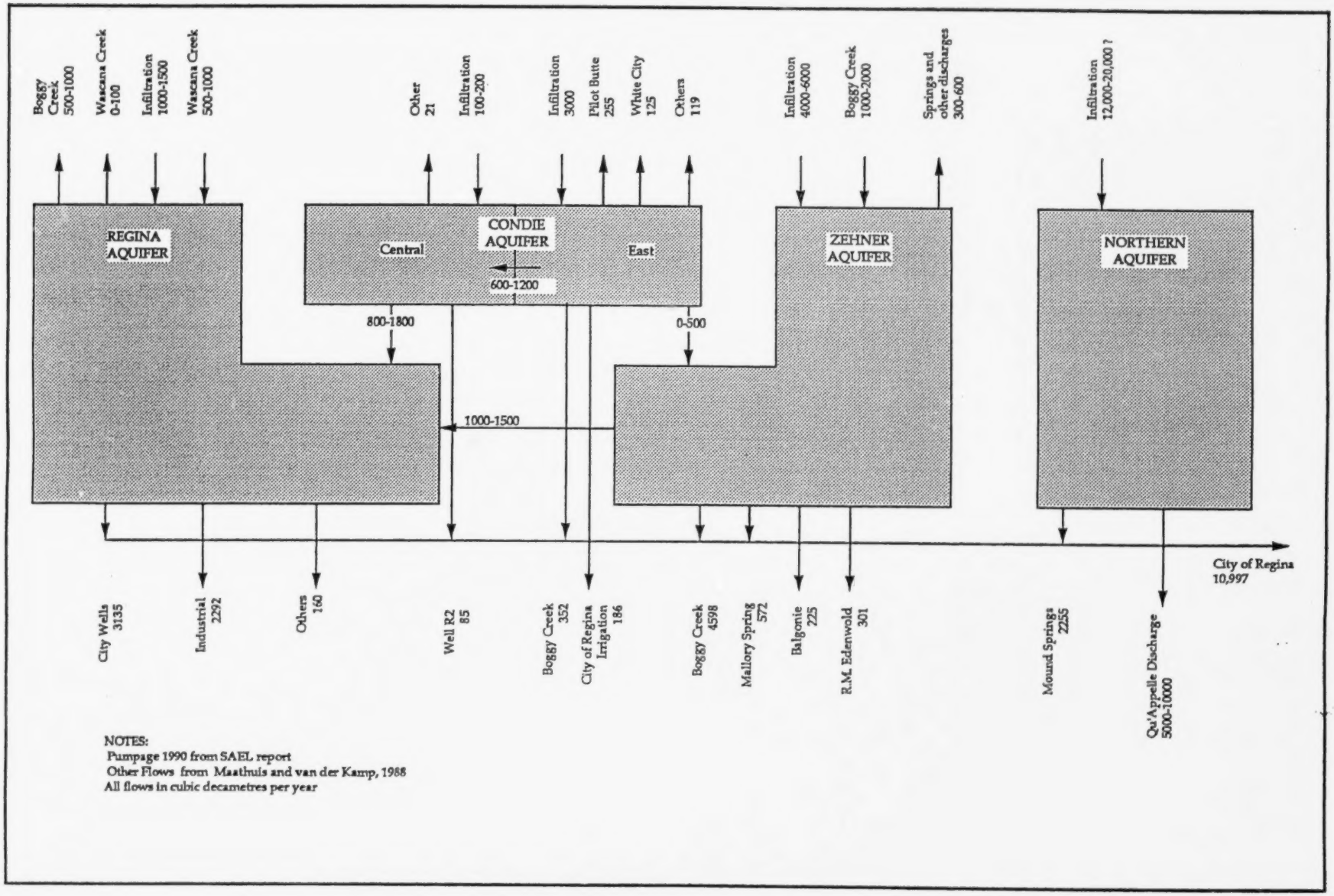
Little information exists on the northern aquifer. Recharge occurs primarily from surface infiltration with natural discharge to springs along the Qu'Appelle Valley. The City of Regina mound springs well field is completed within this aquifer, as well as numerous rural and domestic water supplies.

B.3 Water Balance

Consider the Regina, Condie and Zehner aquifers. The total recharge from infiltration to these aquifers ranges from 9600 to 13,700 cu dam/year (Figure B.3). The current withdrawals from these aquifers is 10,746 and the Year 2000 withdraws are estimated to be 13335 cu dam/year (Table 3.1). These aquifer management units are clearly near capacity.

It is interesting to review, in a qualitative sense, this history of groundwater development. Initially the head in the Regina aquifer was approximately 8 m higher than present. Natural discharges into Wascana Creek, likely in the vicinity of the sewage lagoons and into Boggy Creek downstream of the Condie reservoir at the site of present springs, were significantly greater than present.

Surface water interactions in the Zehner aquifer have also changed significantly with development of the Boggy Creek well fields. The aquifer historically discharged into springs near the Boggy Creek field to the extent that there are reports that at one time Boggy Creek was a perennial stream.



NOTES:
Pumpage 1990 from SAEL report
Other Flows from Maathuis and van der Kamp, 1988
All flows in cubic decametres per year

FIGURE B.3 SCHEMATIC FLOW SYSTEM

The Condie east aquifer is at equilibrium with excess water discharged via springs. Historically, CP Rail and the City of Regina "10 inch infiltration line" have drawn considerable water from the Condie East aquifer with no recorded ill effects.

In summary, historic groundwater development has been primarily at the expense of natural spring discharge to Wascana and Boggy creeks, with some contribution from storage in the Regina aquifer.